



Washoe County School District

Project Title:
Getto Transportation Center Modernization Project

Bid #:
25-15-B-09-DA

Date:
September 30, 2024

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

SECTION 00090 - NOTICE TO CONTRACTORS

Sealed bids for the **Getto Transportation Center Modernization Project** will be received by the Washoe County School District's (WCSD) Purchasing Department located at the Brown Center 14101 Old Virginia Road, Room #0, Reno, NV 89521, **until 2:00 p.m., (Local Time) on November 6, 2024**. The bids will be opened publicly via a TEAMS Meeting at **2:30 pm (local time)**.

MICROSOFT TEAMS MEETING

https://teams.microsoft.com/l/meetup-join/19%3ameeting_N2VkZWE2ZTEtNTE1ZC00MGNhLWEzZTkMjViZTM3MmQwN2M2%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: 251 036 150 853

Passcode: BixUVS

Scope of Work: Provide demolition of all existing buildings, paving, and the removal of the underground storage tanks. Complete the construction of a new 32,000 sq ft. office and maintenance facility including, but not limited to the bus maintenance shop, white fleet maintenance shop, break and training rooms, parts room, tire storage, mechanical mezzanine, a new bus wash building, and above ground fuel tanks and stations, for diesel fuel, unleaded fuel and propane gas. In addition, complete grading, paving, new parking lot, lighting, fencing, and CCTV cameras.

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 1:30 p.m. on October 17, 2024, at Getto Transportation Center (Meet In Front Of The White Fleet Building) 1890 Kleppe Lane, Sparks, NV 89431. Due to access and coordination involved in this project we highly recommend that contractors walk the project site that we are making

available.

The physical work is to be commenced upon issuance of Notice to Proceed and shall be completed as phased in the Special Notifications with an overall completion date on or before September 1, 2026.

Bid #: 25-15-B-09-DA

PWP #: WA-2025-012

Facilitating Buyer: Dawn Allshouse

Email: solicitations@washoeschools.net

To be published in the Reno Gazette Journal on September 30, 2024.

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

Phone: 775-850-8025

Fax: 775-857-3175

Email: solicitations@washoeschools.net

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SECTION 00100 - INSTRUCTION TO BIDDERS

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

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

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

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

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

Bids shall be addressed to the WCSD and delivered to the office of the Purchasing Department, located at the Brown Center, 14101 Old Virginia Road, Room #0, Reno, Nevada 89521, **until 2:00 p.m., (Local Time) on November 6, 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 Notice to Proceed and shall be completed as phased in the Special Notifications with an overall completion date on or before September 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 by **4:30 p.m. (Local Time) on October 24, 2024**. During this active solicitation there shall be no personal contact with any WCSD employees or other parties associated with this project directly. All inquiries shall be done in writing as stated above.

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

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

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

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

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

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

Contractors to be considered as a Preferential Bidder must submit the Certificate of Eligibility for Preferential Status issued by State of Nevada Contractors Board with their bid submission and the Preferential Bidder Status Affidavit must be provided within two

(2) hours after the bid opening, although WCSD prefers the affidavit to also be submitted with the bid at the time of opening.

SPECIAL NOTIFICATIONS

Signature Requirements

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

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

Preferential Bidders

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

Specifications/Addendums

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

Technical Specifications

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

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

The Washoe County School District Structured Cabling Standard – WCSD-SCS-015 dated March 13, 2023 is located on our website. The link to view it is

<https://www.washoeschools.net/cms/lib/NV01912265/Centricity/Domain/70/ITPC%20Images/WCSD-SCS-015%203-10-23.pdf>

Project Completion

The construction contract time allowed for this project is based on a reasonable

expectation of how long it will take to do a project of this scope. WCSD recognizes that Contractors often try to finish projects in significantly less time than the construction contract time and, in such cases, develop schedules which are based on everything going smoothly with no delays. While WCSD allows Contractors to submit such accelerated construction schedules, WCSD reserves the right to deny the Contractor's submission. Acceptance of a submittal with a shortened schedule is not an official agreement between WCSD and the Contractor that the project can be done in less time than the construction contract time specified.

Roof Penetrations

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

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.

Questions

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 by 4:30 p.m. (Local Time) October 24, 2024.

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. Saturday the project site will be available to the Contractor.

Schedule

Please see the drawings for the phased approach to work including the completion dates. Liquidated Damages shall apply by phase and the completion dates that are listed.

FF&E and Move in Clarification

The Awarded Contractor shall include and schedule for the Owner the Furniture, Fixture, and Equipment (FF&E) and Move in from the existing facility to the new facility as shown on Sheet A0.41 - Phase Plan

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.

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.

(Seal)

Principal

By: _____

Surety

By: _____

(Seal)

Address:

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.

(Seal)

Principal

By: _____

(Seal)

Surety

By: _____

Address: _____

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: \$5,000,000 minimum, per occurrence (with \$5,000,000 Aggregate Limit). Refer to Section 00820 – Technical Specifications for important information).

G. ASBESTOS COVERAGE

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

H. PROPERTY COVERAGES

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, general conditions not listed and any BIM updating, Procore updating, or other general expense associated with completing the change in the scope of work. The allowable mark-up fee for contractor bonding shall be in addition to the fee below for the Prime Contractor only and shall not exceed 1% of the change if applicable.

CHANGE ORDER MARK-UP SCHEDULE

1. Additive Changes (for the entity performing the work):	
<u>Total Cost of Change</u> +\$0.01 to +\$50,000 +\$50,000.00 and above	<u>Allowable Fee</u> 15% of the Total Cost 10% of the Total Cost
2. Additive Changes (Contractor Markup) Subcontractors work:	
<u>Total Cost of Change</u> +\$0.01 to +\$50,000 +\$50,000.00 and above	<u>Allowable Fee</u> 10% of the Total Subcontractor Fee 5% of the Total Subcontractor Fee
3. Deductive Changes:	
<u>Total Credit Cost of Change</u> +\$0.01 to +\$50,000 +\$50,000.00 and above	<u>Credit Fee to be Applied</u> 10% of the Total Subcontractor Cost. (Deductive) 5% of the Total Subcontractor Fee (Deductive)
<i>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.</i>	

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

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 $\frac{3}{4}$ ".
- 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 $\frac{1}{2}$ ".
- s. Plumbing lines larger than $\frac{1}{2}$ ".
- 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 ($\frac{1}{2}$) daytime extension.

SECTION 00810 – WAGE RATES AND APPRENTICE UTILIZATION

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

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

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

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

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

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

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

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

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

SECTION 00820 - SPECIAL CONDITIONS

1. TIME OF COMPLETION

The physical work is to commence upon issuance of a Notice to Proceed and shall be completed as phased in the Special Notifications with an overall completion date on or before September 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. 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.

16. OTHER PROJECTS

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

17. EXISTING BUILDING AND CONDITIONS

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

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

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

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

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

Contractor shall hire a qualified, properly Licensed Contractor to test all natural gas lines within area of work for leaks prior to the start of the project and at project completion. Note all gas leaks at the start of the project and report it to the Capital

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

18. MATERIAL DISTURBANCE PERMIT

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

19. WATER SYSTEM DISTURBANCE

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

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

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

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

20. ASBESTOS

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

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

a. Asbestos and the Material Disturbance Permit

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

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

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

The Contractor shall be responsible for all costs incurred by the District including the consultant, sampling and testing, clean-up, replacement of affected equipment, materials, etc., and any legal action that may result

from an asbestos fiber release incident caused by the Contractor or his sub-contractors.

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

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

c. Asbestos – Attachments & Penetrations

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

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

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

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

Once the approval of the WCSD Attachment & Penetration Procedure and training certificates is received, the contractor may schedule the disturbance, but must notify the ES&A Department immediately prior to disturbing the asbestos-containing materials. The Contractor shall provide this notice by calling the ES&A Attachment & Penetration hotline at 325-8490, follow the directions, and leave a message. ES&A Department

personnel, Project Managers, Assistant Project Managers/PCI's, and other district personnel may conduct site visits to ensure compliance with the contractor's submitted and approved procedures.

e. Asbestos Training Certificates – Abatement

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

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

f. Asbestos Training Certificates – Attachment & Penetration

Contractors performing "Attachment & Penetration" work on non-friable asbestos-containing materials, as allowed, and identified in the Material Disturbance Permit, will be required to have a minimum of 16 hours of AHERA asbestos training (Operations & Maintenance, or O&M), as well as an annual refresher certificate if the original training is greater than one year old. Contractor training certificates will be submitted to the Project Manager at least two weeks prior to the start of the project. The ES&A Department will review the submitted training documentation, verify certificates as required, and approve the Attachment & Penetration technicians, so they can work on the assigned WCSD project. No one that has not been approved by the ES&A Department is authorized to perform any asbestos disturbances within the WCSD.

New workers added after the start of the project will be approved by the ES&A Department within one 8-hour work period of the standard Monday thru Friday work schedule. Certification submittal will be serviced by the ES&A Department on a first come, first served basis. Delays to review the documentation will be anticipated and taken into account on any Attachment & Penetration schedule developed, and Attachment & Penetration

technicians will not be allowed to work in any way on that project until their documentation has been reviewed and approved.

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

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

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

21. LEAD PAINTS, COATINGS, CERAMIC TILE, AND LEAD-CONTAINING MATERIALS IN WCSD FACILITIES

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

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

OSHA Regulation CFR 1926.62 – Lead & Appendix A, B, C, & D – Lead Construction Standard.

OSHA Regulation CFR 1910. 1025 - Lead & Appendix A, B, C, & D – General Industry Standard.

EPA, 40 CFR Part 745 – Lead; Renovation, Repair, and Painting Regulation.

b. Lead and the Material Disturbance Permit

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

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

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

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

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

c. Construction Age of Buildings in the District

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

d. Pre – 1978 WCSD Buildings

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

e. Post – 1978 WCSD Buildings

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

The MDP will state all buildings identified above were constructed after 1978. While it was originally thought that paints, coatings and ceramic wall tile are less likely to contain lead in newer WCSD facilities, recent sampling has shown lead-containing paints, coatings, and ceramic tiles DO routinely exist, even in our newest facilities. Due to that finding, Contractors must treat all paints, coatings, and ceramic tile as lead-containing unless WCSD project sampling has proven otherwise, and it will be deemed negative within the MDP and the project scope. **The Bidder/Contractor must comply with all lead-containing or assumed lead-containing paint and coating disturbance instructions and requirements listed in the MDP, District provided lead specifications, and all local, state, and federal regulations, unless the material has been proven, to the satisfaction of the District, that said materials do not contain lead.**

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

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

District and/or District hired EPA Certified Lead Consultant. The lead activities costs will be included into the scope of each project.

g. Lead Attachments & Penetrations

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

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

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

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

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

i. Lead Training Certificates – Removal and Attachments & Penetrations

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

(viii) and all required topics identified in this standard will be completed to include:

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

Certificates of Training showing that technicians have successfully completed an OSHA Lead Action Level course and are required to be properly submitted and approved by the District's ES&A Department prior to any Contractor's technician performing any disturbances to lead-containing or assumed lead-containing paints or coatings, or any other lead-containing materials. The training certificate must have "OSHA Lead Action Level Training" clearly identified on the training certificate and should have a sentence that states that the training topics covered in the class meet or exceed the training topics of OSHA 1926.62(l)(2)(i) thru (viii).

If training certificates are issued for a class, those training certificates need to be submitted. Wallet cards will not be accepted as training certificates unless no training certificate is provided by the training provider. In order for a wallet card to be accepted, the contractor will supply a letter from the training provider stating that no training certificate was provided, and only wallet cards were supplied to attendees. Wallet cards are less desirable due to their small size and mitigate the ability to clearly read and verify all the information on the card. Contractors are encouraged to request a full size 8 1/2" x 11" training certificate from their training providers.

It is important that Contractor's planning on doing the lead work within the District become familiar with the lead training requirements, and spend the

time confirming that the lead classes being taken are truly an OSHA Lead Action Level course, and not a lead awareness course as identified above. Many training providers have differing training class titles on their lead classes, but only training certificates that are noted as above will be accepted to fulfill the listed District's training requirements. Contractors requiring training are responsible in providing the training providers a clear understanding of what training is required.

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

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

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

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

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

In general, all firms that disturb 6 square feet of **lead-based** painted surface per room on the interior, or 20 square feet on the exterior, within a 30 day period in **this** facility, must comply with the EPA's Renovation, Repair and Painting (RR&P) regulation **and** must be registered with the federal EPA. Per the Regulation, the area of disturbance is calculated by adding up the entire

surface areas being removed/disturbed, which then determines the amount of painted surface area disturbed. Work that involves window replacement or demolition of a painted surface, the EPA RR&P regulation applies regardless of size if lead-based paint is present.

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

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

The EPA RR&P regulation requires that personnel disturbing lead containing materials utilize lead safe work practices as identified in the EPA guidance document titled **“steps to lead safe renovation, repair and painting”**, **pages 12 through 23**. This document is available electronically at <http://www.epa.gov/lead/pubs/steps.pdf>. The contractor shall submit lead safe work practice procedures, and all RR&P and OSHA lead action level training certificates to the Project Manager at least two weeks prior to the start of the project. The ES&A Department will review the submitted training documentation and must pre-approve workers so they can work on the assigned WCSD project. No one that has not been approved by the ES&A Department is authorized to perform any lead disturbances.

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

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

k. Lead Air Sampling, Respiratory Protection and Protective Suits

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

22. INDOOR ENVIRONMENTAL QUALITY

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

a. Existing HVAC System:

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

b. Separating Occupied Spaces From Non-Occupied:

Keep work areas separate from occupied spaces with polyethylene sheeting (or similar) if there are no other natural barriers in place OR in spaces where air exchange will occur around the barriers.

c. Ventilation:

During the installation of carpet, paints, furnishings and any other VOC emitting products, provide "spot" ventilation during application/installation and for at least 24 hours after the work is completed. In most cases, opening windows and doors will not be enough to effectively exhaust contaminants. It is recommended that an exhaust fan be used to pull polluted air out of the building. This can be accomplished by placing a fan in a window or door and temporarily sealing any opening around the fan with plastic. Additionally, a door or window at the opposite end of the room should be opened to allow fresh, outdoor air to flow across the work area and sweep polluted air out through the exhaust fan. As long as odors are present, the temporary exhaust

ventilation must continue to operate. This may include nights and weekends, as necessary. Ventilation should continue for a minimum of 24 hours after the completion of the project or until there are no more noticeable odors.

d. Construction Dust:

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

e. After Hours Scheduling:

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

f. Gasoline/Diesel Powered Equipment:

Electric powered equipment must be used in lieu of diesel or gasoline powered equipment. Gas and diesel equipment may not be used inside a WCSD building or near an outdoor fresh air building intake.

g. Material Safety Data Sheets (MSDS):

MSDS must be made be maintained onsite and made available upon request as required by federal law.

h. Construction Completion:

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

i. Air Filters:

Replace all filtration media immediately at the conclusion of the job.

j. Monitoring Air Quality:

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

k. Pre-Construction Work Area Inspection:

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

23. LOCK OUT TAG OUT (LOTO) PROCEDURE

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

SECTION 00830 - TECHNICAL SPECIFICATIONS

I. SUMMARY OF THE WORK:

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

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

II. LOCATION OF THE WORK:

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

Getto Transportation Center
1850 Kleppe Lane
Sparks, NV 89431
Phone #: 775-353-5900
Transportation Manager: Jon Kelley
Site Facilities Coordinator: Jose Ramirez

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

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

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

III. QUESTIONS & CLARIFICATIONS:

For questions and clarifications regarding the Technical Specifications, Drawings, General Conditions, Special Conditions, Bidding and Contract Information contact the Purchasing Department at solicitations@washoeschools.net. **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 by 4:30 p.m. (Local Time) on October 24, 2024.**

IV. MANUFACTURERS:

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

V. ASBESTOS ASSESSMENT:

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

WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT

FACILITY AND MATERIAL LOCATION: Getto Transportation Center

MDP #24-012

DESCRIPTION OF WORK TO BE PERFORMED: Demolish Existing Transportation Center Buildings

IT IS THE RESPONSIBILITY OF THE CONTRACTOR/WORKER TO IDENTIFY MATERIAL TYPE PRIOR TO DISTURBANCE. ONLY MATERIALS LISTED ON THIS PERMIT MAY BE DISTURBED. ANY NEW MATERIAL DISCOVERED OR ANY MATERIAL WHOSE EXACT NATURE OR CHARACTER IS UNCERTAIN REQUIRES A NEW PERMIT PRIOR TO DISTURBANCE. ANY CITATIONS OR ASBESTOS/LEAD CONTAMINATION RESULTING FROM THE IMPROPER OR UNAUTHORIZED DISTURBANCE OF ASBESTOS OR LEAD MATERIALS IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR. A COPY OF THIS PERMIT MUST BE SIGNED BY THE CONTRACTOR AND SUBMITTED TO THE DISTRICT PRIOR TO STARTING THE PROJECT.

ALL ITEMS	MATERIAL DESCRIPTION: SEE FACS REPORT
AHERA MATERIAL NUMBER: N/A	CONTAINS ASBESTOS ?: SEE FACS REPORT
<p><u>MATERIAL DISTURBANCE INSTRUCTIONS:</u> MATERIAL DISTURBANCE INSTRUCTIONS: THE PLANNING DEPARTMENT USED AN OUTSIDE CONSULTING COMPANY (FACS) TO CREATE AN ASBESTOS AND LEAD ASSESSMENT FOR THIS PROJECT. FOR LEAD AND ASBESTOS INFORMATION REFER TO THE FACS REPORT DATED 8/26/22.</p> <p>ANY QUESTIONS RELATED TO ASBESTOS AND LEAD CONTENT, OR DISTURBANCE REQUIREMENTS SHOULD BE ADDRESSED TO THE PLANNING DEPARTMENT, PROJECT MANAGER, OR FACS.</p>	

NOTE: THE ASBESTOS MATERIAL DISTURBANCE INSTRUCTIONS LISTED ABOVE ARE BASED ON THE AHERA REGULATION. THERE MAY EXIST OTHER REGULATIONS THAT MAY BE MORE STRINGENT THEN THESE RECOMMENDATIONS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE COMPLIANCE WITH ALL REGULATIONS THAT ARE APPLICABLE TO THE DISTURBANCE OF ASBESTOS/LEAD CONTAINING MATERIALS. ASBESTOS IS A MICROSCOPIC FIBER AND THE CLEANING OF ASBESTOS DEBRIS MUST BE CONDUCTED TO A MICROSCOPIC LEVEL. IN THE EVENT THAT ANY VISIBLE DEBRIS IS DISCOVERED FROM A DISTURBANCE OR AIR SAMPLING RESULTS ARE NOT PROVIDED TO THE DISTRICT, THE DISTRICT WILL IMMEDIATELY HIRE A THIRD PARTY LEAD/ASBESTOS CONSULTANT TO INVESTIGATE POSSIBLE LEAD/ASBESTOS CONTAMINATION AND AN LEAD/ASBESTOS ABATEMENT CONTRACTOR TO PERFORM ANY RECOMMENDED CLEAN-UP. THE CONTRACTOR WILL BE REQUIRED TO REIMBURSE THE DISTRICT FOR ALL COSTS INCURRED. IF AIR MONITORING IS REQUIRED, AIR MONITORING MUST BE CONDUCTED THROUGHOUT THE PROJECT. AIR MONITORING RESULTS FAXED DIRECTLY FROM THE LAB TO THE ES&A DEPARTMENT @ 851-5695, WITHIN 48 HOURS OF THE DISTURBANCE

DATE ISSUED: September 18, 2024

WASHOE COUNTY SCHOOL DISTRICT

MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT

CONTINUATION PAGE

Material Water & Lead Disturbance Permit, Water System Disturbance Permit Appendix Page #1

Contractors, their sub-contractors or workers are responsible in completing all work without impacting the water quality of District facilities and the domestic water supplies which feed district facilities. This Water System Disturbance Permit identifies the minimum requirements that Contractors, their sub-contractors and all workers will utilize to perform disturbance to the Districts water systems.

The following general requirements shall apply to any person who will be disturbing a District water system. In addition, they must contact the Environmental, Safety and Assessment Department (ES&A Dept) prior to any disturbance at 325-8494. This phone number has an answering machine and can be accessed 24 hours a day. These disturbances will be logged in and documented by the ES&A department.

All requirements for isolation are designed to protect the facility's potable water source from existing as well as potential cross-connections and to prevent any backflow occurrences in the form of backpressure or backsiphonage. The Water Disturbance Procedures listed are not site or incident specific and great care must be taken by technicians during all valving and isolation activities within a facility to prevent a potential backflow occurrence. There may be additional requirements that must be utilized to prevent any cross-connection or backflow occurrence, and each entity performing the disturbance is responsible for ensuring none occur and utilizing any additional steps as necessary to ensure none result from the completion of this project.

Any costs to correct any cross-connections and/or any backflow occurrences that result from the performance of this project are solely the responsibility of the Contractor, their sub-contractor and workers and the signing of this ES&A Department Disturbance Permit on acknowledges and agrees to this requirement.

FACILITY ISOLATION MINIMUM REQUIREMENTS

MECHANICAL ROOMS:

When turning off or disrupting the water service to a mechanical room all applicable requirements below must be conducted per this permit

1. Remove all hoses from custodial faucets and bibs in location to be effected.
2. Shut down all boiler and chiller circulating pumps. Heating, Cooling and Domestic.
3. Shut down boiler, chiller and cooling tower if present.
4. Isolate boiler, cooling tower, chiller and relieve pressure from boiler.
5. Shut down hot water return pump, isolate any hot water heaters and turn off heating source.
6. Isolate domestic service to mechanical room.
7. Re-establish service to mechanical room in reverse order.

BASIC WING:

When turning off or disrupting the water service to a facility wing all applicable requirements below must be conducted per this permit

1. Remove all hoses from custodial, art and science faucets along with bibs in location to be effected.
2. Isolate all water utilizing chemical dispensers in location to be effected.
3. Shut down and isolate any water using equipment if applicable. Hot water heaters, domestic make ups for heat exchangers, photo labs, etc.
4. Isolate domestic cold water main to wing.
5. Re-establish service to wing in reverse order. Flush system at the end of each lateral to remove any and all foreign material and air.

**WASHOE COUNTY SCHOOL DISTRICT
MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT
CONTINUATION PAGE**

Material Water & Lead Disturbance Permit, Water System Disturbance Permit Appendix Page #2

FACILITY:

When turning off or disrupting the water service to a facility all applicable requirements below must be conducted per this permit. Turning off or disturbing the waters services to a facility should only be done as a last resort. If it is possible to isolate the area of disturbance without disrupting facilities entire water service that is the way the project is to be accomplished. This will also keep the contractor, his sub-contractors or workers from having to perform all the listed requirements.

1. Remove all hoses from custodial, art and science faucets along with bibs in entire facility.
2. Isolate mechanical room. See above requirements.
3. Isolate each individual wing where possible. See above requirements.
4. Isolate all irrigation laterals connected to the domestic potable water supply.
5. Isolate domestic cold water main at all locations present to allow as little drain back as possible.
6. Re-establish service to facility in reverse order. Flush system at the end of each lateral to remove any foreign material and air.

WASHOE COUNTY SCHOOL DISTRICT

MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT

CONTINUATION PAGE

PAINTS AND COATINGS – Material Disturbance Permit Appendix - Lead in Paints and Coatings in WCSD Facilities

Lead containing paints and coating are present in WCSD facilities. Bidders/Contractors that disturb lead containing or potentially lead containing paints or coatings, by law, are required to know all applicable regulations applicable and comply with all state and federal regulations that apply to the disturbances to lead paints and coating they are conducting. The regulations that requires by a contractor to be properly trained and knowledgeable, related to lead disturbance includes, but is not limited to the following:

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

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

LEAD CATEGORY #N/A	PAINTS, COATINGS & CERAMIC TILE IN BUILDINGS
CONTAINS LEAD?: SEE FACS REPORT	Buildings: ALL
<p><u>Lead Containing or Assumed Lead Containing Paints and Coatings Disturbance Instructions</u> The planning department used FACS to create an asbestos and lead assessment for this project. For lead and asbestos information refer to the FACS report dated 8/26/22.</p> <p><u>OSHA Requirements</u> All persons performing <u>any</u> disturbance to coatings or paints to paints and coating in and on the buildings listed above must have taken an OSHA lead action level training class from a WCSD, ES&A department approved training provider, and utilize lead safe work practices. In addition, all work must be completed, as a minimum, utilizing the lead safe work practices identified in the EPA guidance document titled “steps to lead safe renovation, repair and painting”, pages 12 thru 23. This document is available electronically at the following link: HTTP://WWW.EPA.GOV/LEAD/PUBS/STEPS.PDF.</p> <p><u>EPA Renovation, Repair and Painting Regulation Requirements</u> In general, all firms that disturb 6 square feet of painted surface in a room or 20 square feet on the exterior within a 30 day period in <u>this</u> facility must comply with the EPA’s Renovation, Remodel and Repair (RR&P) regulation and must be registered with the federal EPA. Per the Regulation, the area of disturbance is calculated, by adding up the entire surface areas being removed/disturbed, which then determines the amount of painted surface area disturbed. Work that involves window replacement or demolition of a painted surface, the RR&P regulation applies regardless of size. This regulation also requires that the contractor must assign a RR&P trained supervisor that is responsible for ensuring and documenting all work is conducted in compliance with the RR&P regulation and there are extensive record keeping and notification requirements that the Contractor must perform. In addition, This is a general overview of the regulation and the contractor must refer to regulation for additional requirements and information. Fines are expensive and the compliance with this regulation rests solely on the Contractor so it is very important that Bidders/Contractors are well versed in this regulation.</p> <p>– CONTINUED SEE NEXT PAGE #11</p>	

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LEAD CATEGORY #N/A	PAINTS, COATINGS & CERAMIC TILE IN BUILDINGS CONSTRUCTED BEFORE 1978
CONTAINS LEAD?: SEE FACS REPORT	Buildings: ALL
<p>– CONTINUED FROM PAGE #10</p> <p><u>WCSD Requirements</u></p> <p>In addition to regulatory requirements, the WCSD has requirements that must be met by the Contractor/Bidder. The contractor is responsible for submitting to the ES&A department lead disturbance procedures that outline the lead safe work practices to be utilized and that procedure must comply with the Districts minimum lead disturbance requirements. The current minimum lead disturbance requirements, which will apply to this project, follow these tables.</p> <p>OSHA action level training and RR&P training certification and RR&P firm certification must be submitted to the project manager and they are to submit a copy to the ES&A department. The ES&A department must review, verify, and approve all required documentation prior to the contractor being able to perform any disturbance, so time for review must be taken into account when developing schedules. Once the ES&A department has approved the procedures and training and firm certification, the contractor may proceed but they must notify the ES&A department at 325-8490 of any paint/coating disturbance immediately disturbance prior to the disturbance. ES&A department personnel, project managers and assistant project managers and other district personnel will spot check in the field, to ensure compliance with the contractors submitted and approved procedures.</p> <p>Refer to section listed below regarding lead sampling that may be available.</p>	

WASHOE COUNTY SCHOOL DISTRICT MATERIAL, WATER, AND LEAD DISTURBANCE PERMIT CONTINUATION PAGE

A NOTE ABOUT SAMPLING AND SAMPLING REQUEST PROCEDURES

Only approximately 20% of the paints and coatings in the District have been found to contain lead. The majority of white and off-white paints on sheetrock and block walls does not contain lead in facilities constructed after approx. 1990. Brighter or more colorful paints/coatings on any surface, or all paints and coatings on metals, are much more likely to be found to contain lead in all facilities. In addition, ceramic tile in any age facility is very likely to contain lead. It is highly recommended that sampling be done to confirm lead content unless time does not allow a delay for processing samples through the WCSD ES&A department. If paints and coatings are not sampled, all paints and coatings must be assumed to be lead containing, above 5000 parts per million (lead based), and treated in accordance with all lead regulations, lead specifications, and requirements identified in this permit.

The process to request lead sampling is for anyone requiring sampling to submit through their project's Project Manager. The designated WCSD Project Manager will submit the required sampling forms, and sampling will be coordinated by the ES&A department. A minimum of 10 days will be allowed before sampling results are provided to the Project Manager for them to be distributed to all interested parties. All lead sampling must be processed through the ES&A department, and sampled by ES&A approved and trained lead professionals.

Any paints or coatings that are not specifically addressed on this permit, or on the project drawings, has to be assumed to be lead containing, and above 5000 parts per million (lead based) – no exceptions. Any disturbance to those paints and coatings not specifically addressed on this permit or on the project drawings must be done by properly trained (Minimum of OSHA action level training) personnel, and those disturbances must be performed in accordance with all lead requirements listed in this permit, as well as any applicable regulations and local requirements. Many times scope modifications are required after the bid, and new areas of the facility may need to be disturbed. These areas would not have been addressed on this permit, since they were unknown at the time of issuance. Additional sampling could be conducted by requesting lead sampling through their project's Project Manager, but there will be a delay getting sampling requests and a new MDP would be required. The District reserves the right to direct the Contractor to assume new paints and coatings, due to scope changes, are lead containing and the contractor would then be required to treat all paints and coatings as lead containing in compliance with all requirements of this permit.

REPLACEMENT PAINTS, COATINGS, CERAMIC TILE, AND OTHER LEAD CONTAINING MATERIALS

Unless otherwise specifically allowed by this projects specifications, the Contractor shall not reinstall any lead containing paints/coatings in any detectable levels during the process of completing this project. "lead containing" is defined as any paint or coating that has ANY detectable lead level when paint chip sampling is conducted and chip is analyzed by the ICP method. The District may perform sampling of replacement materials and if analysis finds any detectable levels of lead, the Contractor will be liable for all costs to properly remove that material and re-apply paints and coatings with no detectable levels of lead. Contractors are encouraged to pre-sample paints they may be using to determine the actual amount in paint/coatings used.

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MINIMUM REQUIREMENTS TO PERFORM ATTACHMENTS AND PENETRATIONS IN WCSD FACILITIES

Below are the minimum requirements to perform any Attachment and Penetration activity to a known or assumed asbestos and/or lead containing material in Washoe County School District (WCSD) facilities. This document is not provided to address demolition, stabilization, abatement, or removal activities. If any work to known or assumed asbestos or lead materials need to be done on this project, and it is anything other than the installation of screws, the removal of screws, or the drilling of holes, the successful bidder must comply with, in addition to these minimum requirements, all applicable District asbestos and lead specifications and requirements. Regarding these procedures, the District has done its best to provide a complete and regulatory compliant attachment and penetration procedure, but by signing this MDP, the Contractor acknowledges that it is the successful bidder's sole responsibility for compliance with this MDP, as well as any other applicable regulatory requirements.

ASBESTOS/LEAD PROCEDURE SUBMISSION PROCESS

Prior to starting this project, each contractor working on this project is required to submit to the WCSD ES&A department an asbestos/lead procedure that includes all District requirements listed below. To simplify the procedure submittal process, an electronic PDF fillable template of these requirements will be provided to the successful bidder of this project. This document is available by contacting the assigned WCSD Capital Projects Project Manager for this project. Contractors must utilize the most current above-mentioned electronic template and fill out all required information, add company letterhead, sign, and date the document. The completed procedures will be e-mailed to the Project Manager by all contractors working on this project that will performing any applicable disturbances. Once submitted, the WCSD Project Manager will pass the document onto the ES&A department for approval. Successful bidders are required to add time to their project schedule for this procedure submittal and approval process.

The Contractor has the option to submit a site-specific or blanket district-wide applicable procedure. A district-wide blanket procedure applies to a scheduled project, as well as all future sites where a contractor will be performing disturbances. The site specific procedure will apply to just one site or project. District-wide procedures are valid for one year from the date the procedure is signed by the ES&A department. Site specific procedures will be valid for the term of the project. Each Contractor must receive a signed and approved procedure prior to performing any disturbances to all asbestos/lead paint or assumed asbestos/lead paint materials. The procedure is a combined procedure and it addresses both asbestos and lead disturbances. A minimum of one work day will be required by the ES&A department for the review and approval process.

In addition to the Material Disturbance Permit (MDP), the Contractors must also have a copy of the approved procedures on site at all times. The purpose of this procedure is to document the agreement between the Contractor and the District that all lead and asbestos disturbances performed by staff of the Contractor will be done per all noted District requirements, District Specifications, and project specifications. Again, Contractors must ensure that their procedure has been approved, and the approved signed procedure is on site prior to any disturbance.

MINIMUM REQUIREMENTS

1. Receive approved Lead/Asbestos procedures as identified above.
2. Technicians performing disturbances will be required to have a minimum of AHERA 16 Hour O&M training and OSHA action level training per 29 CFR 1926.62 (i) (2) lead training. In addition, as applicable, contractors must comply with the EPA RR&P training and certifications requirements listed in the RR&P section of this appendix. Copies of training certifications, including a refresher within the last 12 months, will be provided to the ES&A Department **prior** to the start of any project. Only personnel with the proper minimum training will be authorized to perform any disturbance to asbestos/lead paint or assumed asbestos/lead paint containing materials, or be in the adjacent area of a disturbance.
3. Notify the ES&A Department at **325-8490** and leave a message with the time, name of the technician doing the work, date and exact locations in the school where they will be performing any disturbance. This call should take place immediately prior to disturbance, this phone number (**325-8490**) will go to voice mail, and the contractors are to provide notifications with above identified information, 24 hours a day. The Contractor is also required to notify their assigned WCSD Construction Department Project Managers and Assistant Project Managers of scheduled disturbances so they can also verify compliance with the contractors approved disturbance procedures.

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4. Contractors must refer to this Material Disturbance Permit to determine what materials contain asbestos or lead and utilize the applicable lead/asbestos procedures. Some materials cannot be disturbed, and each specific material disturbance permit will identify what can be disturbed and provided material disturbance instructions. The minimum disturbance permits in this section of the material permit are in addition to any requirements listed in the material disturbance instructions. Any instance where 100% of the minimum asbestos/lead requirements are not followed, the District will immediately hire an environmental remediation contractor as well as an environmental consultant to properly clean up the contamination and perform air sampling. The contractor will be responsible for reimbursing the District for all costs due to any improper or unauthorized disturbances.
5. Contractors or technicians who are new to performing asbestos/lead paint or assumed asbestos/lead paint disturbances for the District must contact the Capital Projects PM/PCI Department and schedule a disturbance. A Capital Projects PM/PCI employee will be scheduled to review the technician's compliance with the disturbance procedures in the field. Once a technician has demonstrated on a minimum of two (2) occasions to the Capital Projects Department that he has an understanding of the District disturbance requirements and has proper equipment, the ES&A Department will then authorize that technician to perform disturbances without prior approval of the Capital Projects Department. Notifications prior to starting all disturbances as listed above will still be required and technicians should expect unannounced random compliance inspections, from the ES&A Department. A list of approved technicians is available upon request from the ES&A department.
6. Post the appropriate "Danger Lead - Keep Out" or "Danger Asbestos Keep Out" signs on the entry side of all doors leading into classrooms, hallways, bathrooms, offices or mechanical rooms where drilling is to occur. Doors will be closed. It is the contractor /technician's responsibility to take adequate means to keep the public or school staff out of the disturbance area.
7. Large rooms, such as multipurpose rooms, will have yellow caution tape placed across all entries to the room in addition to signage but access to these areas must be restricted to ensure no unprotected person can enter the areas where disturbances are taking place. If unprotected personnel can see the activity, this is not a large enough area of demarcation.
8. A 6 ml plastic drop will be placed under the disturbance in a manner that extends 6' out in all directions from the disturbance area. This poly drop can be reused if properly wet-wiped or HEPA-vacuumed off after use.
9. Worker will don the respiratory protection and a protective suit, (protective suits are optional for lead disturbance, "attachments and penetration" disturbances if the Contractor will not exceed the lead action level) and initiate personal air monitoring procedures per item #10 below. Respiratory protection is required throughout all asbestos/lead paint or assumed asbestos/lead paint disturbances in WCSD regardless of air sampling results.
10. If a Contractor is performing a **lead** attachments and penetrations (see the definition in #20 below), air sampling will be conducted at the start of the project. If air sampling results show the technicians performing the work is below the OSHA Lead Action Level, air sampling can be suspended unless the work being performed is changed. Air sampling will be performed for each type of lead attachment and penetration activity to develop a representative sample for each lead activity. Air sampling will be performed during **all** asbestos disturbances, no exceptions.
11. Drill the hole or holes as required using an HEPA VAC and a shrouded or dust collecting apparatus (i.e. Bit Buddy. A HEPA VAC is to remain running during this whole process to ensure all debris is cleared from hole. All clean-up must be conducted the HEPA Vacuum. If a contractor fails to properly control the asbestos/lead containing dust, the District will then hire an environmental remediation contractor as well as an environmental consultant to properly clean up the contamination. The contractor will be responsible for reimbursing the District for all costs due to improper disturbances that result in debris exiting the area of disturbance.
12. All HEPA vacuums used will have been DOP challenge tested prior to first use and annually thereafter. If this project involves 30 or more disturbances over the span of this project, the HEPA vacuum will be DOP tested on-site prior to the start of the project.

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13. If required, to be determined by the technician, an encapsulant material may be sprayed or brushed on to the area of the holes.
14. A device, backing, box or raceway, or any other equipment will then be mounted using anchors installed per #11 above, with the HEPA VAC running and properly directed at the area of the disturbance.
15. A HEPA VAC or wet methods will be used to clean up any debris on 6ml poly drop, around device box, technician's suit, and any surfaces below holes, such as tops of chalkboards and base boards.
16. The poly drop, if utilized, will be folded into itself in such a manner as to not spread any debris, the HEPA vacuum hose sealed, and personal air monitoring time logged appropriately. This poly drop can be reused if it is properly wet-wiped or HEPA-vacuumed off after use.
17. All signs and equipment are to be removed, and the technician is to move to the next location. The contaminated suit should be removed and a new suit utilized at the new disturbance location, unless the suit can be properly decontaminated.
18. Upon completion of a shift, air samples will be dated and sent in to a properly accredited lab to be analyzed. Results will be forwarded to WCSD. Lab results will be e-mailed directly from the lab to the ES&A Department within 48 hours of the disturbance. All lab results will reference the Material Disturbance Permit (MDP) # located on the top of the first page of this permit. Results without the MDP number prefix will be returned to the lab for clarification and the addition of the MDP tracking number
19. All debris, waste, poly drop, suits, etc. will be placed in 6 mil poly waste bags (double bagged) and disposed of properly.
20. The definition of "Attachment and Penetrations" in this document is only the drilling of holes through a HEPA shrouded device, the installation of screws through a HEPA shrouded device, or the removal of screws through a HEPA shrouded device. Any other activity that is not attachments and penetrations as listed in item #20 must be designed by an asbestos or lead project designer, done per a lead specification, and supervised by the District or District hired outside asbestos/lead consultant. Contractors cannot perform any work, other than "Attachments and Penetrations" without an onsite District or District hired asbestos or Lead Consultant being present.
21. All asbestos abatement or lead disturbances, other than "Attachment and Penetrations", must be completed in full compliance with applicable regulations, the District's Asbestos Abatement Specifications, and District hired asbestos or lead consultants supplement specifications. If in error, an asbestos abatement bid or quote is put forth without the District Asbestos Abatement Specifications, Contractors are required to request a copy of the most current asbestos abatement specifications from the bid or quote entity through the formal bid inquiry process

THE UNDERSIGNED AGREES TO COMPLY WITH THE CONDITIONS OF THIS MATERIAL, WATER & LEAD DISTURBANCE PERMIT, APPENDIXES, & ALL APPLICABLE REGULATIONS. UNDERSIGNED ACKNOWLEDGES LIABILITY FOR ANY COSTS THE DISTRICT MAY INCUR TO INVESTIGATE & CLEAN UP ANY DISCOVERY OF IMPROPER AND/OR UNAUTHORIZED DISTURBANCES DONE BY UNDERSIGNED'S EMPLOYEE(S) OR SUB-CONTRACTOR(S) TO MATERIALS LISTED AS LEAD/ASBESTOS-CONTAINING BY THE DISTRICT. IN ADDITION, THE UNDERSIGNED AGREES TO ALL REQUIREMENTS OF THE WATER & LEAD APPENDIX.

SIGNED BY (PRINT): _____ SIGNATURE: _____

COMPANY (PRINT): _____

DATE RECEIVED: _____

August 26, 2022

Asbestos & Lead Survey Report

**Washoe County School District
Getto Transportation Center
Site Demolition Project**
1850 Kleppe Lane
Sparks, NV 89431

Prepared for:

Teresa Golden, Director
Planning and Design – Capital Projects
Washoe County School District
14101 Old Virginia Road
Reno, NV 89521
(775) 325-8301 |
Teresa.Golden@washoeschools.net

Prepared By:

Daniel Prado, Project Manager
Forensic Analytical Consulting Services
4600 Kietzke Lane, B118
Reno, NV 89502
775-391-3524 | dprado@forensicanalytical.com

FACS Project #PJ71737

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**Appendix A: Asbestos Functional Space Notes,
Asbestos Sample Chain-of-Custody, and Laboratory
Results Report**

**Appendix B: Lead Bulk Sample Results Summary, Lead
Sample Chain-of-Custody, and Laboratory Results
Reports, XRF Survey Data Table**

Appendix C: Site Photographs

Appendix D: Sample Location Drawings

**Appendix E: Certifications of Personnel and
Laboratories**

List of Acronyms

AAC	Asbestos Abatement Consultant
ACM	Asbestos Containing Material
AHERA	Asbestos Hazard Emergency Response Act
AIHA	American Industrial Hygiene Association
CFR	Code of Federal Regulation
DIR	Division of Industrial Relations
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency (EPA)
FACS	Forensic Analytical Consulting Services, Inc.
LCP	Lead-Containing Paints and Coatings
LBP	Lead-Based Paints and Coatings
ND	None Detected
NESHAP	National Emissions Standard Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Science and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
PCM	Phase Contrast Microscopy
PLM	Polarized Light Microscopy
SGS-FL	SGS-Forensic Laboratories
TEM	Transmission Electron Microscopy
TTLC	Total Threshold Limit Concentration

Executive Summary

Forensic Analytical Consulting Services, Inc. (FACS) was retained by Washoe County School District to perform an asbestos and lead paint survey of the Getto Transportation Center, located at 1850 Kleppe Lane in Sparks, Nevada. The survey included suspect asbestos-containing materials (ACM) and suspect paints and coatings which will be disturbed during an upcoming demolition project at the site. A previous roof survey by FACS on July 31, 2021, was reviewed and results incorporated into this report. Appendix A of this report includes a Functional Spaces Notes Report for all spaces and suspect materials, or components inspected during this survey. Appendix B of this report includes a lead paint sample summary table and XRF Survey Data Tables for all paints and coatings sampled that are suspected to contain lead as part of this survey. This survey was performed from August 10 and 11, 2022.

Asbestos

Please refer to the attached Functional Spaces Notes Report in Appendix A for identification of materials and asbestos-content. Materials will be listed as being non-suspect for asbestos, sampled and found to be none-detect for asbestos, or will be assumed, known, or have a percentage of asbestos identified.

The following materials were found to be asbestos-containing by laboratory analysis:

- Penetration Mastic, White – (3% Chrysotile)
- Drywall, Stipple Texture – (2% Chrysotile)
- Drywall, Orange Peel Texture – (2% Chrysotile)
- Laminate Flooring & Glue – (70% Chrysotile)
- Black Mastic – (2% Chrysotile)

The following materials were found to contain asbestos during previous surveys by Washoe County School District's Environmental, Systems, & Assessment Department.

- VFT & Mastic – 12" Light Blue Oatmeal – 200 Building
- Carpet & Mastic – Green Wave – 200 Building
- Transite Panels – 200 Building, Exterior
- Drywall – Light Knockdown Texture – 300 Building
- Fire Doors – 90 Minute Rating – Main Building
- TSI w/Hard Elbows (various sizes) – Main Building
- Hardpack Pipe Wrap (various sizes) – Main Building
- Drywall – Knockdown Texture (2nd floor) – Main Building

Any suspect materials not included in this inspection must be assumed to be asbestos-containing materials until tested and proven to be asbestos-free.

Lead

The following paints, coatings and components were found to be lead-based by XRF analysis. The spaces noted with components are spaces of sampling and these materials may exist in additional spaces.

- Blue-grey paint on wood paneling – 300 Building Exterior
- Yellow paint on metal pole – 400 Building Exterior
- Red paint on metal pillar – Main Building Exterior

The following paints were identified to be lead containing by laboratory analysis:

- Gray paint on concrete floor – Building B
- White paint on drywall wall – Building 200, Space 201
- Red paint on concrete wall – Building B, Space 32
- Dark gray paint on wood doorframe – 300 Building
- Dark blue paint on wood trim – 300 Building, Exterior
- White and black paint on wood (mosaic) – Storage Shed, Exterior
- Yellow paint on CMU wall – 300 Building, Space 303
- Red paint on concrete curb – Exterior parking lot
- Light blue paint on metal roofing – 200, 400 Building, Exterior
- Blue gray paint on CMU – Building 300, Exterior
- White paint on CMU – Building 300 All interior CMU
- Steel blue paint on wood trim – 400 Building, Exterior
- White paint on concrete floor – 300 Building, Space 300
- White paint on concrete wall – 200,400 Building, Exterior
- White paint on concrete floor – Main building, Space 26
- Medium blue paint on metal door – 200 Building

The following paints do not contain lead above the laboratory's reporting limit and may be handled as "lead-free" by any personnel:

- Light Blue paint on drywall – 200 Building, Space 200

All other paints were found to be lead-containing by XRF analysis. This includes, but is not limited to, all paints on interior components, exterior curbs, exterior pillars, and storage tanks.

See attached XRF Report Form in Appendix B for locations tested during this survey. Any paints or coatings not included in testing must be handled as lead-containing unless sampled and proven otherwise.

Introduction

Forensic Analytical Consulting Services, Inc. (FACS) was retained by Washoe County School District to perform an asbestos and lead paint survey of the Getto Transportation Center, located at 1850 Kleppe Lane in Sparks, Nevada. The survey included suspect asbestos-containing materials (ACM) and suspect paints and coatings which will be disturbed during an upcoming demolition at the site. A previous roof survey by FACS on July 31, 2021 was reviewed and the results incorporated this report. The survey was performed from August 10 and 11, 2022.

Scope of Work

The purpose of this survey was to identify asbestos-containing materials (ACMs) and lead-containing paints and coatings that will be disturbed as part of upcoming demolition project at the site. The visual inspection, bulk sampling, and survey documentation were performed by Daniel Prado, Zachary Ramos, Ryan Hettich, and Alec Cornelius. Mr. Prado is licensed by the Division of Industrial Relations (DIR) as an Asbestos Abatement Consultant (AAC). Mr. Prado and Mr. Ramos are US EPA-accredited Asbestos Hazard Emergency Response Act Building Inspectors. Mr. Prado is also a US EPA Certified Lead Inspectors / Assessors. Mr. Cornelius and Mr. Hettich assisted with scribing notes and photographs for this survey. The scope of the survey and the services provided by FACS included:

- Performing a visual inspection of the site to identify accessible suspect asbestos-containing materials (ACMs) present;
- Collection of bulk material samples for asbestos analysis by polarized light microscopy (PLM);
- Performing a visual inspection of the buildings and structures for suspect lead-containing paints and coatings and analyzing these materials using a x-ray fluorescence spectrum analyzer;
- Collection of bulk paint chip samples for lead analysis by inductively coupled plasma (ICP) analysis;
- Ensuring the technical quality of all work by using Asbestos Hazard Emergency Response Act (AHERA) accredited Building Inspectors;
- Ensuring the technical quality of all work by using US EPA Certified Lead Inspector / Assessors;
- Consolidating data and findings into a report format.

Site Characterization

Getto Transportation Center is a bus lot comprised of five buildings with a concrete exterior and single-ply roofing on the exterior of Buildings A and B.. The exterior of the 200's, 300's, and 400's buildings are comprised of CMU, corrugated metal, wood siding, and composite shingle roofing. Interior areas in all buildings are comprised of various materials including but not limited to, concrete, vinyl floor tile, drywall, carpet, baseboards, linoleum, mastics, and false ceiling tile systems. This inspection also included any out-buildings or aboveground tanks that will be demolished as part of the project at this site.

Survey Methods

Document Review

Documents available from the Washoe County School District's Environmental, Safety, and Assessment Department were reviewed for past sampling results. The results from past inspections conducted were used as available and applicable still to the site based on the results of FACS' visual survey and identification of materials on District records. A previous roof survey by FACS performed on July 31, 2021 was referenced in this report.

Visual Inspection

Accessible building materials were visually inspected using the methods presented in the Federal AHERA regulations (40 CFR, Part 763). AHERA inspection methodology is required to be used for inspections of K-12 schools and is generally accepted as the industry standard for all ACM inspections regardless of structure or facility type. Suspect ACMs were also physically assessed for friability, condition and possible disturbance factors. In addition, FACS followed ASTM standards for inspections as required by Washoe County Health District.

All areas were accessible during this inspection. Destructive methods used to investigate behind materials or above ceilings was performed as available, but not completed for every area or situation. As this structure may not be demolished immediately, destructive sampling methods were not used that may potentially lead to a hazard being left onsite.

Asbestos Inspection

Bulk Sample Collection

Bulk samples of identified homogeneous materials were collected from materials that may be impacted by the planned renovation activities. Samples were collected of each separate homogeneous area. A homogeneous area is defined as a surfacing material, thermal system insulation, or miscellaneous material that is uniform in use, color and texture. Examples of homogeneous areas could include:

- Vinyl floor tiles
- False ceiling panels
- Drywall with joint compound
- Vinyl sheet flooring

The specific number of samples collected was determined by using the methods required by the Federal AHERA regulations (40 CFR, Part 763.86) and ASTM standards as noted below:

- 1) For Surfacing Material:
 - 1,000 ft² or less – collect 3 samples
 - 1,001 to 5,000 ft² – collect 5 samples
 - 5,001 ft² or greater – collect 7 samples
- 2) For Thermal System Insulation:
 - "In a randomly distributed manner" – collect 3 samples
 - 6 linear feet of patching or less – collect 1 sample
 - cementitious pipe fittings – "In a manner sufficient to determine"

3) For all Miscellaneous Material:

Collect samples “In a manner sufficient to determine whether material is ACM (asbestos-containing material) or not ACM”... – AHERA

Collect “A minimum of three bulk samples shall be collected of each homogeneous miscellaneous material, except that a single sample may suffice for small manufactured items such as HVAC vibration dampeners, gaskets and friction products. This exception applies to individual components of less than 6 ft² (0.557 m²) in size and not to multiple installations of similar components.” – ASTM E2356 – 18 Standard

The suspect ACMs were sampled using a knife, chisel, scraper, drill or other similar coring device suitable to the type of material sampled to cut through its entire thickness and to ensure that a cross-section of the material was obtained. The material was then placed in an appropriately labeled container that was sealed and submitted to SGS-Forensic Laboratories for analysis. A unique sample number (e.g. PJ71737-01A) was assigned to each sample.

Bulk samples will be retained by the laboratory for one month unless otherwise instructed. After this period, the samples will be disposed of appropriately.

Bulk Sample Analysis

A total of 182 bulk samples were collected from a total of 69 suspect materials. Bulk samples were analyzed by SGS – Forensic Laboratories (SGS-FL) in Carson, California. SGS-FL is accredited by the National Institute of Science and Technology’s (NIST) National Voluntary Laboratory Accreditation Program (NVLAP). SGS-FL participates in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing Program and has substantial experience in the analysis of asbestos.

All samples were analyzed using Polarized Light Microscopy with Dispersion Staining (PLM/DS) techniques in accordance with the methodology approved by the U.S. Environmental Protection Agency (EPA). The percentage of asbestos present in the samples was determined on the basis of a visual area estimation. The EPA defines asbestos-containing materials (ACM) as any material containing more than one percent (1%) asbestos as determined using the method specified in Appendix A, Subpart F, 40 CFR Part 763, Section 1, Polarized Light Microscopy (PLM). 40 CFR Part 763 identifies the lower limit of reliable quantification for asbestos using the PLM method as approximately one percent (1%) by volume. In addition to the percentages, the types of asbestos minerals are also reported. The PLM method is the standard method used to analyze asbestos bulk samples.

When "None Detected" (ND) appears in the laboratory results, it should be interpreted as meaning asbestos was not observed in the sample material.

Lead Inspection

The client-defined lead inspection was modeled upon the sampling protocol described in “Chapter 7: Lead Based Paint Inspection” of the HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (1997 Revision).

OSHA, in Title 29 Code of Federal Regulations (CFR) Part Number 1926, Standard Number 1926.62, regulates all construction work where an employee may be occupationally exposed to lead. Paints, coatings, or materials with any detectable level of lead is considered lead-containing by OSHA. Paints or coatings containing lead above 1.0 mg/cm², 0.5% by weight, or 5,000 parts per million are considered lead-based by the US EPA.

For purposes of this report, materials containing lead shall be defined as materials that XRF testing has identified as containing a lead content at or above 0.01 mg/cm², or 0.00 mg/cm² readings which have not been confirmed with laboratory analysis of bulk samples. In addition, any laboratory analysis of bulk samples that find detectable concentrations of lead will be handled as lead-containing.

XRF Testing Methodology

Surfaces and components were surveyed for lead content utilizing a portable X-ray fluorescence (XRF) analyzer, Niton Model 300 XLp, serial number 100252. The XRF analyzer contains a radioactive cadmium source which bombards tested surfaces with X-rays and gamma rays. This external energy source excites any lead atoms within the tested paint or coating, causing their atoms to emit X-ray photons with a characteristic energy profile. The instrument analyzes the emitted energy to identify and quantify the amount of lead in the tested paint or coating, with lead content reported in milligrams per square centimeter.

Testing combinations of homogeneous components in one area are representative of similar components found in other areas. During this survey, the inspector visually identified the painted or coated component to test, an XRF reading was collected, and the reading was documented in the XRF data table contained in Appendix B. For each test reading, the data table identifies the room equivalent/space designation, the tested component name, the substrate material, the sample location, paint/coating color, condition assessment, and the XRF results expressed as lead content reported in milligrams per square centimeter (mg/cm²).

Bulk Sample Methodology

XRF testing performed during this survey was used to determine which paints or coatings at the site have detectable concentrations of lead, and to determine which paints or coatings at the site are lead-based paint. OSHA does not accept XRF test results for use in determining that a paint or coating does not contain lead. OSHA requires laboratory analysis of a bulk sample to classify a paint or coating as lead-free.

During this inspection, FACS personnel collected 49 bulk paint chip samples from 17 suspect paints for laboratory confirmation of lead-content. These samples were scraped from the substrate using a knife or chisel to obtain sufficient material for analysis. Each sample was given a unique marker number, (e.g. PJ71737-01-Pb-A) identified on a chain-of-custody, packaged, and sent via FedEx to SGS – Forensic Laboratories (SGS-FL) in Carson, California for analysis. SGS-FL is accredited by the American Industrial Hygiene Association's Environmental Lead Laboratory Accreditation Program for the analysis of lead in bulk paint chips by inductively coupled plasma.

Findings and Recommendations

Forensic Analytical Consulting Services, Inc. (FACS) was retained by Washoe County School District to perform an asbestos and lead paint survey of the Getto Transportation Center, located at 1850 Kleppe Lane in Sparks, Nevada. The survey included suspect asbestos-containing materials (ACM) and suspect paints and coatings which will be disturbed during an upcoming demolition project at the site. The survey was performed from August 10 and 11, 2022.

Asbestos

Please refer to the attached Functional Spaces Notes Report in Appendix A for identification of materials and asbestos-content. Materials will be listed as being non-suspect for asbestos, sampled and found to be none-detect for asbestos, or will be assumed, known, or have a percentage of asbestos identified.

The following materials are known to contain asbestos or were determined to contain asbestos based on sampling during this survey:

- Penetration Mastic, White – (3% Chrysotile)
- Drywall, Stipple Texture – (2% Chrysotile)
- Drywall, Orange Peel Texture – (2% Chrysotile)
- Laminate Flooring & Glue – (70% Chrysotile)
- Black Mastic – (2% Chrysotile)

The following materials are known to contain asbestos due to previous surveys by Washoe County's ES&A Department.

- VFT & Mastic – 12" Light Blue Oatmeal – 200 Building
- Carpet & Mastic – Green Wave – 200 Building
- Transite Panels – 200 Building, Exterior
- Drywall – Light Knockdown Texture – 300 Building
- Fire Doors – 90 Minute Rating – Main Building
- TSI w/Hard Elbows (various sizes) – Main Building
- Hardpack Pipe Wrap (various sizes) – Main Building
- Drywall – Knockdown Texture (2nd floor) – Main Building

Any suspect materials not included in this inspection must be assumed to be asbestos-containing materials until tested and proven to be asbestos-free.

The demolition at this site would fall under the regulatory requirements of the Washoe County Health District. A notification for the demolition of the structures will need to be filed at least 10 working days prior to any demolition of structural members. In addition, this 10-working day notification will need to be filed prior to the abatement of asbestos-containing materials if they are categorized as a regulated asbestos-containing material (RACM) or if they are non-friable materials that will be removed using mechanical means (e.g. removal of floor mastic with a buffer). Material disposal would be based on the friability of material, method of removal, and requirements of any other project-specific obligations.

To comply with the AHERA regulation and OSHA requirements, workers performing asbestos abatement will need to have AHERA Worker training with at least one worker trained to the AHERA Contractor-Supervisor level. Workers will need to use asbestos work practices required by OSHA for the appropriate abatement class of work being performed along with any project-specific work plans. A notification must be submitted to the local OSHA office for the abatement of asbestos-containing materials.

The contractor performing abatement of asbestos-containing materials will need to hold the A-23 license from the Nevada State Contractors Board and as required by the Nevada Administrative Code (NAC) 624.150(23).

Lead

The following paints, coatings and components were found to be lead-based by XRF analysis. The spaces noted with components are spaces of sampling and these materials may exist in additional spaces.

- Blue-gray paint on wood paneling – 300 Building Exterior
- Yellow paint on metal pole – 400 Building Exterior
- Red paint on metal pillar – Main Building Exterior

Bulk sampling of paints and components was performed to verify lead-content of materials. The following paints were identified to be lead containing by ICP laboratory analysis:

- Gray paint on concrete floor – Building B
- White paint on drywall wall – Building 200, Space 201
- Red paint on concrete wall – Building B, Space 32
- Dark gray paint on wood doorframe – 300 Building
- Dark blue paint on wood trim – 300 Building, Exterior
- White and black paint on wood (mosaic) – Storage Shed, Exterior
- Yellow paint on CMU wall – 300 Building, Space 303
- Red paint on concrete curb – Exterior parking lot
- Light blue paint on metal roofing – 200, 400 Building, Exterior
- Blue gray paint on CMU – Building 300, Exterior
- White paint on CMU – Building 300 All interior CMU
- Steel blue paint on wood trim – 400 Building, Exterior
- White paint on concrete floor – 300 Building, Space 300
- White paint on concrete wall – 200,400 Building, Exterior
- White paint on concrete floor – Main building, Space 26
- Medium blue paint on metal door – 200 Building

The following paints do not contain lead above the laboratory's reporting limit and may be handled as "lead-free" by any personnel:

- Light blue paint on drywall – 200 Building, Space 200

All other paints were found to be lead-containing by XRF analysis. This includes, but is not limited to, all paints on interior components, exterior curbs, exterior pillars, and storage tanks.

Any paints or coatings not included in testing must be handled as lead-containing unless sampled and proven otherwise.

OSHA regulates the handling of paints and coatings containing lead down to any detectable concentration. Therefore, workers that will handle paints or coatings on this project must have lead training. For work with Washoe County School District, this training must be OSHA Action Level training at minimum. Any contractor with workers disturbing any quantity of detectable lead must perform an initial determination regarding worker exposures to lead, which may be based on personal air monitoring at the start of the project, prior employee monitoring from the past 12 months under workplace conditions closely resembling the current project, or objective data demonstrating that exposures will not exceed the OSHA action level (30 micrograms per cubic meter of air). It is the employer's responsibility to conduct the initial determination and comply with any relevant OSHA requirements.

Workers must use lead-safe work practices when disturbing paints or coatings that contain lead. Disturbance of lead-containing paints or coatings must be performed within a contained area to prevent the spread and build-up of lead dust. HEPA vacuums, dustless tools or shrouds, and/or intact removal of components should be employed to minimize lead dust generation and work areas must be properly cleaned following disturbance to lead-containing materials during this project. Waste generated during

disturbance to lead-containing materials must be profiled in a hazardous waste determination to ascertain proper disposal requirements.

FACS recommends that the results of this report be incorporated into any renovation plans provided for this project for informational purposes.

Limitations

This investigation is limited to the conditions and practices observed, and information made available to FACS. The methods, conclusions and recommendations provided are based on FACS' judgment, expertise, and the standard of practice for professional service. They are subject to the limitations and variability inherent in the methodology employed. As with all environmental investigations, this investigation is limited to the defined scope and does not purport to set forth all hazards, nor indicate that other hazards do not exist.

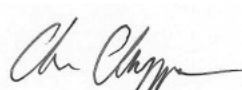
Please do not hesitate to contact our office at 775-993-7389 with any questions or concerns. Thank you for the opportunity to assist Washoe County School District with promoting worker safety and a healthy environment.

Respectfully,
FORENSIC ANALYTICAL



Daniel Prado
Project Manager, Reno
IJPM-2057
US EPA LBP-R-I214705-1

Reviewed by:
FORENSIC ANALYTICAL



Chris Chipponeri
Local Director, Central Valley Offices
IJPM-1410
US EPALBP-R-128230-2

Appendix A

Asbestos Functional Space Notes, Asbestos Sample Chain-of-Custody, and Laboratory Results Report



Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

FACS Project Number: PJ71737

Date of Inspection: August 10, 2022

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Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 01 - 200's Building

Building Comment: *White Fleet Quonset Hut*

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>01 - 200's Building</u>		Room: <u>01 - Exterior - 57 x 24 x 13</u>				
Walls: Concrete	MISC	None Detected	3	3A, 3B, 3C	1606 sq	
Walls: Doorframe Sealant - White	MISC	None Detected	4	4A, 4B, 4C	60 ln	
Walls: Transite Panels	MISC	Known	19		150 sq	No
<i>Comment: N Side of Building</i>						
Walls: Wood Siding	NON	Non-Suspect				
Ground: Concrete Sidewalk	MISC	None Detected	1	1A	250 sq	
Roof: Metal	NON	Non-Suspect				
Roof: Metal Roof Sealant - Grey	MISC	None Detected	2	2A, 2B	90 sq	
Roof: Penetration Mastic - White	MISC	3 % Ch	5	5A, 5B	30 sq	No
Building: <u>01 - 200's Building</u>		Room: <u>02 - Space 200A - Entry - 12 x 6 x 12</u>				
Floor: VFT & Mastic - 12" Lt Blue Oatmeal	MISC	Known	6		72 sq	No
Baseboard: Baseboard & Mastic - 4" Black	MISC	None Detected	7	7C	36 ln	
Walls: Concrete	MISC	None Detected	3		173 sq	
Walls: Wood Paneling	NON	Non-Suspect				
Ceiling: Wood Ceiling Panels	NON	Non-Suspect				
Building: <u>01 - 200's Building</u>		Room: <u>03 - Space 200 - Storage - 48 x 20 x 13</u>				
Floor: Carpet & Mastic - Green Wave	MISC	Known	8		912 sq	No
<i>Comment: Residual asbestos-containing mastic found in sample 3D</i>						
Floor: Concrete	MISC	None Detected	3	3D	960 sq	
<i>Comment: Residual asbestos-containing mastic from carpet remains on concrete floor - Sample 3D for reference</i>						
Baseboard: Baseboard & Mastic - 4" Black	MISC	None Detected	7	7A, 7B	136 ln	
Walls: Concrete	MISC	None Detected	3		584 sq	
Walls: Drywall - Smooth Texture	MISC	None Detected	9		300 sq	
Walls: Wood Paneling	NON	Non-Suspect				
Ceiling: Wood Ceiling Panels	NON	Non-Suspect				

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 01 - 200's Building

Building Comment: *White Fleet Quonset Hut*

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>01 - 200's Building</u>		Room: <u>04 - Space 201 - Restroom - 14 x 6 x 8</u>				
Floor: Linoleum & Glue - Grey Pebble	MISC	None Detected	10	10A, 10B, 10C	84 sq	
Baseboard: Baseboard & Mastic - 4" Grey	MISC	None Detected	11	11A, 11B, 11C	40 ln	
Walls: Concrete	MISC	None Detected	3		20 sq	
Walls: Drywall - Smooth Texture	MISC	None Detected	9	9A, 9B, 9C	272 sq	
Walls: Wood Paneling	NON	Non-Suspect				
Ceiling: Drywall - Smooth Texture	MISC	None Detected	9		84 sq	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 02 - 300's Building
Building Comment: White Fleet Shop

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
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Building: <u>02 - 300's Building</u>	Room: <u>01 - Exterior - 120 x 60 x 15</u>
Walls: CMU & Grout	MISC None Detected 12 12A, 12B 5400 sq
Walls: Frame Sealant - White	MISC None Detected 14 14A, 14B, 14C 40 ln
Walls: Wood Siding	NON Non-Suspect
Roof: Comp Shingle Roofing - Grey	MISC None Detected 13 13A, 13B, 13C, 13D 7200 sq
Ground: Concrete Sidewalk	MISC None Detected 1 1B 200 sq
Roof: Patch Mastic - Black	MISC None Detected 16 16A, 16B 12 sq
Roof: Penetration Mastic - Grey	MISC None Detected 15 15A, 15B, 15C 10 sq

Building: <u>02 - 300's Building</u>	Room: <u>02 - Space 303 - Repair Shop - 50 x 20 x 10</u>
Floor: Concrete	MISC None Detected 3 3G 1000 sq
Walls: CMU & Grout	MISC None Detected 12 350 sq
Walls: Drywall - Stipple Texture	MISC 1 - 2 % Ch 17 17B, 17C 1050 sq No
Ceiling: FCP - 2' x 2' Pinhole Fissure	MISC None Detected 18 18A, 18B 1000 sq

Building: <u>02 - 300's Building</u>	Room: <u>03 - Restroom Hall - 11 x 4 x 12</u>
Floor: VFT & Mastic - 12" White-Blue Oatmeal	MISC None Detected 20 20A 44 sq
Walls: Drywall - Stipple Texture	MISC 1 - 2 % Ch 17 360 sq No
Ceiling: Drywall - Stipple Texture	MISC 1 - 2 % Ch 17 44 sq No

Building: <u>02 - 300's Building</u>	Room: <u>04 - Space 305 - Restroom - 7 x 6 x 8</u>
Floor: VFT & Mastic - 12" Dark Grey	MISC None Detected 21 21A, 21B 42 sq
Walls: CMU & Grout	MISC None Detected 12 52 sq
Walls: Drywall - Stipple Texture	MISC 1 - 2 % Ch 17 17D 156 sq No
Ceiling: Drywall - Stipple Texture	MISC 1 - 2 % Ch 17 42 sq No

Building: <u>02 - 300's Building</u>	Room: <u>05 - Space 306 - Restroom - 7 x 6 x 8</u>
Floor: VFT & Mastic - 12" Dark Grey	MISC None Detected 21 21C 42 sq
Walls: CMU & Grout	MISC None Detected 12 52 sq
Walls: Drywall - Stipple Texture	MISC 1 - 2 % Ch 17 156 sq No
Ceiling: Drywall - Stipple Texture	MISC 1 - 2 % Ch 17 42 sq No
Sink: Restroom Sealant - White	MISC None Detected 22 22A 6 ln

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 02 - 300's Building

Building Comment: *White Fleet Shop*

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>02 - 300's Building</u>		Room: <u>06 - Space 307 - Storage - 11 x 3 x 8</u>					
Floor:	VFT & Mastic - 12" White-Blue Oatmeal	MISC	None Detected	20	20B, 20C	33 sq	
Walls:	CMU & Grout	MISC	None Detected	12		112 sq	
Walls:	Drywall - Tape & Joint	MISC	None Detected	24	24A, 24B, 24C	45 sq	
Walls:	Drywall - Unfinished	MISC	None Detected	23	23C	67 sq	
Ceiling:	Drywall - Unfinished	MISC	None Detected	23	23B	33 sq	
Building: <u>02 - 300's Building</u>		Room: <u>07 - Space 308 - Storage - 14 x 12 x 9</u>					
Floor:	VFT & Mastic - 24" Grey Pebble	MISC	None Detected	25	25A, 25B, 25C	168 sq	
Baseboard:	Wood	NON	Non-Suspect				
Walls:	Drywall - Light Knockdown Texture	MISC	Known	26		468 sq	No
Walls:	Wood Paneling	NON	Non-Suspect				
Ceiling:	FCP - 2' x 2' Pinhole Fissure	MISC	None Detected	18		168 sq	
Building: <u>02 - 300's Building</u>		Room: <u>08 - Space 309 - Storage - 13 x 11 x 9</u>					
Floor:	Concrete	MISC	None Detected	3		143 sq	
Walls:	CMU & Grout	MISC	None Detected	12		108 sq	
Walls:	Drywall - Stipple Texture	MISC	1 - 2 % Ch	17	17E	324 sq	No
Ceiling:	FCP - 2' x 2' Pinhole Fissure	MISC	None Detected	18	18C	143 sq	
Building: <u>02 - 300's Building</u>		Room: <u>09 - Space 310 - Office - 14 x 13 x 9</u>					
Floor:	Concrete	MISC	None Detected	3		182 sq	
Walls:	CMU & Grout	MISC	None Detected	12		122 sq	
Walls:	Drywall - Stipple Texture	MISC	1 - 2 % Ch	17		364 sq	No
Ceiling:	FCP - 2' x 2' Pinhole Fissure	MISC	None Detected	18		182 sq	
Building: <u>02 - 300's Building</u>		Room: <u>10 - Space 300 - Vehicle Maintenance - 50 x 50 x 15</u>					
Floor:	Concrete	MISC	None Detected	3		2500 sq	
Floor:	Expansion Joint - Grey	MISC	None Detected	27	27A, 27B, 27C	75 ln	
Walls:	CMU & Grout	MISC	None Detected	12		2250 sq	
Walls:	Drywall - Stipple Texture	MISC	1 - 2 % Ch	17	17A	750 sq	No
Walls:	Drywall - Unfinished	MISC	None Detected	23	23A	300 sq	
Ceiling:	Fiberglass Batts w/ Paper	MISC	None Detected	28	28A	2500 sq	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 02 - 300's Building

Building Comment: *White Fleet Shop*

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>02 - 300's Building</u>		Room: <u>11 - Space 301 - Parts Storage - 24 x 14 x 12</u>					
Floor:	Concrete	MISC	None Detected	3		336 sq	
Walls:	CMU & Grout	MISC	None Detected	12		228 sq	
Walls:	Drywall - Stipple Texture	MISC	<u>1 - 2 % Ch</u>	17		684 sq	No
Ceiling:	Drywall - Stipple Texture	MISC	<u>1 - 2 % Ch</u>	17		336 sq	No
Ceiling:	FCP - 2' x 2' Pinhole Fissure	MISC	None Detected	18		15 sq	
Building: <u>02 - 300's Building</u>		Room: <u>12 - Space 302 - Parts Storage - 24 x 14 x 10</u>					
Floor:	Concrete	MISC	None Detected	3		336 sq	
Walls:	CMU & Grout	MISC	None Detected	12		380 sq	
Walls:	Drywall - Stipple Texture	MISC	<u>1 - 2 % Ch</u>	17		380 sq	No
Ceiling:	FCP - 2' x 2' Pinhole Fissure	MISC	None Detected	18		336 sq	
Building: <u>02 - 300's Building</u>		Room: <u>13 - Attic - 70 x 60 x 5</u>					
Floor:	Drywall - Stipple Texture	MISC	<u>1 - 2 % Ch</u>	17			No
	<i>Comment: Material Amounts accounted for in other spaces</i>						
Walls:	Wood	NON	Non-Suspect				
Ceiling:	Fiberglass Batts w/ Paper	MISC	None Detected	28	28B, 28C	4200 sq	
Ducts:	Fiberglass Insulation	NON	Non-Suspect				

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 03 - 400's Building
Building Comment: White Fleet Office

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>03 - 400's Building</u>		Room: <u>01 - Exterior - 90 x 20 x 12</u>				
Walls: CMU & Grout	MISC	None Detected	12	12C	528 sq	
Walls: Concrete	MISC	None Detected	3	3E	660 sq	
Walls: Siding Sealant - White	MISC	None Detected	38	38A, 38B, 38C	100 ln	
Walls: Wood Siding	NON	Non-Suspect				
Roof: Comp Shingle Roofing - Grey	MISC	None Detected	13	13E, 13F, 13G	1320 sq	
Ground: Concrete Sidewalk	MISC	None Detected	1		250 sq	
Roof: Metal	NON	Non-Suspect				
Roof: Metal Roof Sealant - Grey	MISC	None Detected	2	2C	45 sq	
Roof: Patch Mastic - Black	MISC	None Detected	16	16C	5 sq	
Roof: Penetration Mastic - White	MISC	3 % Ch	5	5C	5 sq	No
Windows: Windowframe Sealant - Black	MISC	None Detected	39	39A, 39B, 39C	30 ln	
Building: <u>03 - 400's Building</u>		Room: <u>02 - Space 400 - Offices - 20 x 15 x 8</u>				
Floor: Carpet & Mastic - Tan Squares	MISC	None Detected	29	29A	300 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Drywall - Orange Peel Texture	MISC	2 % Ch	30	30A, 30B	560 sq	No
Ceiling: Drywall - Orange Peel Texture	MISC	2 % Ch	30		300 sq	No
Building: <u>03 - 400's Building</u>		Room: <u>03 - Space 401 - Hallway - 11 x 3 x 8</u>				
Floor: Carpet & Mastic - Tan Squares	MISC	None Detected	29		33 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Drywall - Orange Peel Texture	MISC	2 % Ch	30	30C	224 sq	No
Ceiling: Drywall - Orange Peel Texture	MISC	2 % Ch	30		33 sq	No
Building: <u>03 - 400's Building</u>		Room: <u>04 - Space 402 - Storage - 12 x 12 x 8</u>				
Floor: Carpet & Mastic - Tan Squares	MISC	None Detected	29	29B	144 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Drywall - Orange Peel Texture	MISC	2 % Ch	30	30D	384 sq	No
Ceiling: Drywall - Orange Peel Texture	MISC	2 % Ch	30		144 sq	No

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 03 - 400's Building

Building Comment: *White Fleet Office*

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>03 - 400's Building</u>		Room: <u>05 - Space 403 - Conference - 20 x 15 x 8</u>					
Floor:	VSF & Glue - Faux Wood	MISC	None Detected	31	31A	300 sq	
Baseboard:	Wood	NON	Non-Suspect				
Walls:	Drywall - Orange Peel Texture	MISC	<u>2 % Ch</u>	30	30E	560 sq	No
Ceiling:	Drywall - Orange Peel Texture	MISC	<u>2 % Ch</u>	30		300 sq	No
Building: <u>03 - 400's Building</u>		Room: <u>06 - Space 404 - Copy Room - 9 x 8 x 8</u>					
Floor:	VSF & Glue - Faux Wood	MISC	None Detected	31		72 sq	
Baseboard:	Wood	NON	Non-Suspect				
Walls:	Drywall - Heavy Knockdown Texture	MISC	None Detected	32	32A, 32B, 32C	272 sq	
Ceiling:	Drywall - Heavy Knockdown Texture	MISC	None Detected	32		72 sq	
Building: <u>03 - 400's Building</u>		Room: <u>07 - Basement - 50 x 15 x 5</u>					
Floor:	Concrete	MISC	None Detected	3		750 sq	
Walls:	Concrete	MISC	None Detected	3	3F	650 sq	
Ceiling:	Wood	NON	Non-Suspect				
Building: <u>03 - 400's Building</u>		Room: <u>08 - Space 405 - Dispatch - 24 x 16 x 10</u>					
Floor:	Carpet & Mastic - Tan Squares	MISC	None Detected	29	29C	384 sq	
Baseboard:	Wood	NON	Non-Suspect				
Walls:	Wood Panels w/ Texture	TSI	None Detected	33		800 sq	
Ceiling:	Wood Panels w/ Texture	TSI	None Detected	33		384 sq	
Building: <u>03 - 400's Building</u>		Room: <u>09 - Space 406 - Entry - 12 x 12 x 10</u>					
Floor:	Laminate Flooring & Glue <i>Comment: Under Current Flooring</i>	MISC	<u>70 % Ch</u>	34		144 sq	No
Floor:	VSF & Glue - Faux Wood	MISC	None Detected	31		144 sq	
Baseboard:	Wood	NON	Non-Suspect				
Walls:	Wood Panels w/ Texture	TSI	None Detected	33	33C	480 sq	
Ceiling:	Wood Panels w/ Texture	TSI	None Detected	33	33D	144 sq	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 03 - 400's Building
Building Comment: White Fleet Office

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 03 - 400's Building		Room: 10 - Exterior Entry - 6 x 4 x 7				
Floor: Concrete	MISC	None Detected	3		24 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Drywall - Orange Peel Texture	MISC	2 % Ch	30		35 sq	No
Walls: Wood	NON	Non-Suspect				
Ceiling: Wood	NON	Non-Suspect				
Building: 03 - 400's Building		Room: 11 - Space 407 - Office - 12 x 7 x 10				
Floor: Laminate Flooring & Glue <i>Comment: Under Current Flooring</i>	MISC	70 % Ch	34		84 sq	No
Floor: VSF & Glue - Faux Wood	MISC	None Detected	31		84 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Wood Panels w/ Texture	TSI	None Detected	33		380 sq	
Ceiling: Wood Panels w/ Texture	TSI	None Detected	33		84 sq	
Building: 03 - 400's Building		Room: 12 - Space 408 - Utility - 7 x 4 x 10				
Floor: Mastic - Black <i>Comment: Residual Mastic on Wood Floor</i>	MISC	2 % Ch	35	35A, 35B, 35C	28 sq	No
Floor: Wood	NON	Non-Suspect				
Baseboard: Wood	NON	Non-Suspect				
Walls: Wood Panels w/ Texture	TSI	None Detected	33	33A, 33B	220 sq	
Ceiling: Wood Panels w/ Texture	TSI	None Detected	33		28 sq	
Pipes: Foil Tape & Glue	MISC	None Detected	36	36A	15 sq	
HVAC: HVAC Mastic - Grey	MISC	None Detected	37	37A	12 ln	
Building: 03 - 400's Building		Room: 13 - Space 409 - Restroom - 7 x 5 x 10				
Floor: Laminate Flooring & Glue <i>Comment: Under Existing Flooring</i>	MISC	70 % Ch	34	34A, 34B	35 sq	No
Floor: VSF & Glue - Faux Wood	MISC	None Detected	31		35 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Wood Panels w/ Texture	TSI	None Detected	33		240 sq	
Ceiling: Wood Panels w/ Texture	TSI	None Detected	33		35 sq	
Sink: Restroom Sealant - White	MISC	None Detected	22	22B	6 ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 03 - 400's Building
Building Comment: White Fleet Office

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 03 - 400's Building		Room: 14 - Space 410/411 - Restroom - 10 x 7 x 10				
Floor: Laminate Flooring & Glue <i>Comment: Under Existing Flooring</i>	MISC	70 % Ch	34	34C	70 sq	No
Floor: VSF & Glue - Faux Wood	MISC	None Detected	31	31C	70 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Wood Panels w/ Texture	TSI	None Detected	33		340 sq	
Ceiling: Wood Panels w/ Texture	TSI	None Detected	33		70 sq	
Sink: Restroom Sealant - White	MISC	None Detected	22		6 ln	
Building: 03 - 400's Building		Room: 15 - Space 412 - Storage - 7 x 6 x 10				
Floor: Laminate Flooring & Glue <i>Comment: Under Current Flooring</i>	MISC	70 % Ch	34		42 sq	No
Floor: VSF & Glue - Faux Wood	MISC	None Detected	31	31B	42 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Wood Panels w/ Texture	TSI	None Detected	33	33E	260 sq	
Ceiling: Wood Panels w/ Texture	TSI	None Detected	33		42 sq	
Building: 03 - 400's Building		Room: 16 - Space 413 - Kitchen - 14 x 6 x 10				
Floor: Laminate Flooring & Glue <i>Comment: Under Current Flooring</i>	MISC	70 % Ch	34		84 sq	No
Floor: VSF & Glue - Faux Wood	MISC	None Detected	31		84 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Wood Panels w/ Texture	TSI	None Detected	33		400 sq	
Ceiling: Wood Panels w/ Texture	TSI	None Detected	33		84 sq	
Building: 03 - 400's Building		Room: 17 - Space 414 - Hallway - 20 x 4 x 10				
Floor: Laminate Flooring & Glue <i>Comment: Under Current Flooring</i>	MISC	70 % Ch	34		80 sq	No
Floor: VSF & Glue - Faux Wood	MISC	None Detected	31		80 sq	
Baseboard: Wood	NON	Non-Suspect				
Walls: Wood Panels w/ Texture	TSI	None Detected	33		480 sq	
Ceiling: Wood Panels w/ Texture	TSI	None Detected	33		80 sq	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: *Main Building*

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>04 - Building A</u>		Room: <u>01 - Exterior - 90 x 120 x 24</u>					
Walls:	Concrete (Main Buildings)	MISC	None Detected	42		10080 sq	
Walls:	Expansion Joint	MISC	None Detected	64	64A	250 ln	
Ground:	Concrete Sidewalk	MISC	None Detected	1	1C	200 sq	
Windows:	Frame Sealant - Tan	MISC	None Detected	69	69A, 69B, 69C	250 ln	
Roof:	Penetration Mastic - White (MB)	MISC	None Detected	68	02A, 02B, 02C	50 sq	
Roof:	Single-Ply Roofing - White	MISC	None Detected	41	01A, 01B	10800 sq	
Building: <u>04 - Building A</u>		Room: <u>02 - Space 1A - Admin Lobby - 16 x 10 x 10</u>					
Floor:	Carpet & Mastic - Grey Multi	MISC	None Detected	57	57C	160 sq	
Baseboard:	Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		52 ln	
Walls:	Concrete w/Texture	SURF	None Detected	61	61E	260 sq	
Walls:	Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		260 sq	
Ceiling:	FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60	60A	160 sq	
Building: <u>04 - Building A</u>		Room: <u>03 - Space 1 - Open Area - 45 x 20 x 10</u>					
Floor:	VFT & Mastic - 24" Light Grey Pebble	MISC	None Detected	62	62A	900 sq	
Baseboard:	Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		130 ln	
Walls:	Concrete w/Texture	SURF	None Detected	61	61A	650 sq	
Walls:	Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		650 sq	
Walls:	Expansion Joint	MISC	None Detected	64		30 ln	
Ceiling:	FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60		900 sq	
Building: <u>04 - Building A</u>		Room: <u>04 - Space 11 - Hallway - 75 x 4 x 10</u>					
Floor:	VFT & Mastic - 24" Light Grey Pebble	MISC	None Detected	62		300 sq	
Baseboard:	Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		158 ln	
Walls:	Concrete w/Texture	SURF	None Detected	61	61B, 61D	948 sq	
Walls:	Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		632 sq	
Walls:	Expansion Joint	MISC	None Detected	64		40 ln	
Ceiling:	FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60	60B	300 sq	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: Main Building

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: 04 - Building A		Room: 05 - Space 2 - Office - 14 x 12 x 10				
Floor: Carpet & Mastic - Grey Multi	MISC	None Detected	57		168 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		52 ln	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		520 sq	
Ceiling: FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60		168 sq	
Building: 04 - Building A		Room: 06 - Space 4 - Office - 15 x 8 x 10				
Floor: Carpet & Mastic - Grey Multi	MISC	None Detected	57		120 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		46 ln	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		460 sq	
Ceiling: FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60		120 sq	
Building: 04 - Building A		Room: 07 - Space 4A - Main Entry - 16 x 14 x 10				
Floor: VFT & Mastic - 24" Light Grey Pebble	MISC	None Detected	62	62C	224 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58	58C	60 ln	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59	59E	600 sq	
Ceiling: FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60	60C	224 sq	
Building: 04 - Building A		Room: 08 - Space 6 - Exterior Entry - 8 x 6 x 10				
Floor: Concrete (Main Buildings)	MISC	None Detected	42		48 sq	
Walls: Glass	NON	Non-Suspect				
Ceiling: Metal	NON	Non-Suspect				
Building: 04 - Building A		Room: 09 - Space 7 - Office - 14 x 12 x 10				
Floor: Carpet & Mastic - Grey Multi	MISC	None Detected	57		168 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		52 ln	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		520 sq	
Ceiling: FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60		168 sq	
Building: 04 - Building A		Room: 10 - Space 9 - Office - 14 x 12 x 10				
Floor: Carpet & Mastic - Grey Multi	MISC	None Detected	57		168 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		52 ln	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		520 sq	
Ceiling: FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60		168 sq	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: Main Building

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>04 - Building A</u>		Room: <u>11 - Space 10 - Office - 14 x 12 x 10</u>				
Floor: Carpet & Mastic - Grey Multi	MISC	None Detected	57		168 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		52 ln	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		520 sq	
Ceiling: FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60		168 sq	
Building: <u>04 - Building A</u>		Room: <u>12 - Space 12 - Office - 15 x 8 x 8</u>				
Floor: Carpet & Mastic - Grey Multi	MISC	None Detected	57	57A, 57B	120 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		46 ln	
Walls: Concrete (Main Buildings)	MISC	None Detected	42		92 sq	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		276 sq	
Ceiling: Concrete (Main Buildings)	MISC	None Detected	42		100 sq	
Ceiling: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		20 sq	
Building: <u>04 - Building A</u>		Room: <u>13 - Space 18 - Hallway - 20 x 4 x 9</u>				
Floor: VFT & Mastic - 24" Light Grey Pebble	MISC	None Detected	62		80 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		48 ln	
Walls: Concrete (Main Buildings)	MISC	None Detected	42		25 sq	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		432 sq	
Ceiling: Concrete (Main Buildings)	MISC	None Detected	42		80 sq	
Building: <u>04 - Building A</u>		Room: <u>14 - Space 21A - Women's RR Foyer - 6 x 4 x 9</u>				
Floor: VFT & Mastic - 24" Light Grey Pebble	MISC	None Detected	62		24 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		20 ln	
Walls: Concrete w/Texture	SURF	None Detected	61	61C	90 sq	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		90 sq	
Ceiling: Concrete (Main Buildings)	MISC	None Detected	42		24 sq	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: Main Building

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>04 - Building A</u>		Room: <u>15 - Space 21 - Women's Restroom - 14 x 10 x 9</u>					
Floor:	Epoxy - Grey Pebble	MISC	None Detected	65		140 sq	
Baseboard:	Epoxy - Grey Pebble	MISC	None Detected	65		48 ln	
Walls:	Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		432 sq	
Walls:	FRP & Glue - White	MISC	None Detected	66		216 sq	
Ceiling:	Concrete (Main Buildings)	MISC	None Detected	42		140 sq	
Sink:	Restroom Sealant - White	MISC	None Detected	22		6 ln	
Building: <u>04 - Building A</u>		Room: <u>16 - Space 18C - Custodial - 6 x 5 x 9</u>					
Floor:	Concrete (Main Buildings)	MISC	None Detected	42		30 sq	
Baseboard:	Concrete (Main Buildings)	MISC	None Detected	42		22 ln	
Walls:	Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		198 sq	
Walls:	FRP & Glue - White	MISC	None Detected	66	66A, 66B, 66C	25 sq	
Ceiling:	Concrete (Main Buildings)	MISC	None Detected	42		30 sq	
Building: <u>04 - Building A</u>		Room: <u>17 - Space 19A - Mens RR Foyer - 6 x 4 x 9</u>					
Floor:	VFT & Mastic - 24" Light Grey Pebble	MISC	None Detected	62	62B	24 sq	
Baseboard:	Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		20 ln	
Walls:	Concrete w/Texture	SURF	None Detected	61		90 sq	
Walls:	Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		90 sq	
Ceiling:	Concrete (Main Buildings)	MISC	None Detected	42		24 sq	
Building: <u>04 - Building A</u>		Room: <u>18 - Space 19 - Men's Restroom - 14 x 10 x 9</u>					
Floor:	Epoxy - Grey Pebble	MISC	None Detected	65		140 sq	
Baseboard:	Epoxy - Grey Pebble	MISC	None Detected	65	65A, 65B	48 ln	
Walls:	Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		432 sq	
Walls:	FRP & Glue - White	MISC	None Detected	66		216 sq	
Ceiling:	Concrete (Main Buildings)	MISC	None Detected	42		140 sq	
Sink:	Restroom Sealant - White	MISC	None Detected	22	22C	6 ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: *Main Building*

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>04 - Building A</u>		Room: <u>19 - Space 17 - Office - 13 x 9 x 9</u>				
Floor: Carpet & Mastic - Grey Multi	MISC	None Detected	57		117 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58	58A	44 ln	
Walls: Concrete w/Texture	SURF	None Detected	61		99 sq	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59	59G	297 sq	
Ceiling: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		117 sq	
Building: <u>04 - Building A</u>		Room: <u>20 - Space 16 - Office - 13 x 11 x 9</u>				
Floor: VFT & Mastic - 24" Light Grey Pebble	MISC	None Detected	62		143 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		48 ln	
Walls: Concrete w/Texture	SURF	None Detected	61		108 sq	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59	59F	324 sq	
Ceiling: Concrete (Main Buildings)	MISC	None Detected	42		143 sq	
Building: <u>04 - Building A</u>		Room: <u>21 - Space 26 - Garage - 110 x 60 x 24</u>				
Floor: Concrete (Main Buildings)	MISC	None Detected	42	42C	6600 sq	
Floor: Expansion Joint - White	MISC	None Detected	46	46A, 46B, 46C	350 ln	
Walls: Concrete (Main Buildings)	MISC	None Detected	42		8160 sq	
Walls: Expansion Joint	MISC	None Detected	64	64C	160 ln	
Ceiling: Fiberglass Insulation	NON	Non-Suspect				
Pipes: Fiberglass Pipe Wrap - 4" w/ Hard Elbow	TSI	Known	47		300 ln	No
<i>Comment: 40 Hard Elbows & Sections of Mudded Fiberglass Pipe Wrap Throughout</i>						
Pipes: Fiberglass Pipe Wrap - 6" w/ Hard Elbow	TSI	Known	48		220 ln	Yes
<i>Comment: 14 Hard Elbows & Sections of Mudded Fiberglass Pipe Wrap Throughout</i>						
Door: Fire Door - 90 Min Rated	MISC	Known	49		2 ea	No
<i>Comment: On South Side of Space</i>						
HVAC: Vibration Dampener - Black	MISC	None Detected	45	45A	1 ea	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: Main Building

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
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Building: 04 - Building A	Room: 22 - Space 15 - Parts Storage - 34 x 20 x 8
Floor: Concrete (Main Buildings)	MISC None Detected 42 680 sq
Floor: Expansion Joint - White	MISC None Detected 46 40 ln
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC None Detected 58 58B 108 ln
Walls: Concrete w/Texture	SURF None Detected 61 432 sq
Walls: Drywall - Knockdown Texture (1st Floor)	MISC None Detected 59 432 sq
Ceiling: Concrete (Main Buildings)	MISC None Detected 42 680 sq

Building: 04 - Building A	Room: 23 - West Stairs - 16 x 4 x 12
Floor: Concrete (Main Buildings)	MISC None Detected 42 64 sq
Baseboard: Wood	NON Non-Suspect
Walls: Drywall - Knockdown Texture (2nd Floor)	MISC Known 50 480 sq No
Ceiling: Fiberglass Insulation	NON Non-Suspect

Building: 04 - Building A	Room: 24 - Space 13 - Haz Storage - 13 x 12 x 9
Floor: Concrete (Main Buildings)	MISC None Detected 42 156 sq
Walls: Concrete (Main Buildings)	MISC None Detected 42 225 sq
Walls: Drywall - Smooth Texture (1st Floor)	MISC None Detected 63 63A, 63B, 63C 225 sq
Ceiling: Concrete (Main Buildings)	MISC None Detected 42 156 sq

Building: 04 - Building A	Room: 25 - Space 24 - Stair Entry - 8 x 4 x 8
Floor: VFT & Mastic - 12" Beige Oatmeal	MISC None Detected 67 67A, 67B, 67C 32 sq
Baseboard: Drywall - Knockdown Texture (1st Floor)	MISC None Detected 59 24 ln
Walls: Concrete w/Texture	SURF None Detected 61 48 sq
Walls: Drywall - Knockdown Texture (1st Floor)	MISC None Detected 59 144 sq
Ceiling: Concrete (Main Buildings)	MISC None Detected 42 32 sq

Building: 04 - Building A	Room: 26 - East Stairs - 16 x 4 x 12
Floor: Concrete (Main Buildings)	MISC None Detected 42 64 sq
Baseboard: Wood	NON Non-Suspect
Walls: Drywall - Knockdown Texture (2nd Floor)	MISC Known 50 480 sq No
Ceiling: Fiberglass Insulation	NON Non-Suspect

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: *Main Building*

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>04 - Building A</u>		Room: <u>27 - Space 22 - Locker Room - 15 x 15 x 9</u>				
Floor: Epoxy - Grey Pebble	MISC	None Detected	65		225 sq	
Baseboard: Epoxy - Grey Pebble	MISC	None Detected	65	65C	60 ln	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59	59D	540 sq	
Ceiling: Concrete (Main Buildings)	MISC	None Detected	42		225 sq	
Pipes: Fiberglass Pipe Wrap - 4" w/ Hard Elbow <i>Comment: 2 Hard Elbows</i>	TSI	Known	47		4 ln	Yes
Sink: Restroom Sealant - White	MISC	None Detected	22		6 ln	
Building: <u>04 - Building A</u>		Room: <u>28 - Locker Room Closet - 6 x 3 x 9</u>				
Floor: Epoxy - Grey Pebble	MISC	None Detected	65		18 sq	
Baseboard: Epoxy - Grey Pebble	MISC	None Detected	65		18 ln	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59	59A, 59B, 59C	162 sq	
Ceiling: Concrete (Main Buildings)	MISC	None Detected	42		18 sq	
Building: <u>04 - Building A</u>		Room: <u>29 - Space 25 - Admin - 22 x 14 x 7</u>				
Floor: Carpet & Mastic - Grey Multi	MISC	None Detected	57		308 sq	
Baseboard: Baseboard & Mastic - 4" Black (MB)	MISC	None Detected	58		72 ln	
Walls: Concrete w/Texture	SURF	None Detected	61		44 sq	
Walls: Drywall - Knockdown Texture (1st Floor)	MISC	None Detected	59		460 sq	
Ceiling: FCP - 2' x 4' Pinhole Fissure	MISC	None Detected	60		308 sq	
Building: <u>04 - Building A</u>		Room: <u>30 - Space 29 - Loft Break Room - 38 x 22 x 9</u>				
Floor: Concrete (Main Buildings)	MISC	None Detected	42		836 sq	
Walls: Concrete (Main Buildings)	MISC	None Detected	42		540 sq	
Walls: Drywall - Knockdown Texture (2nd Floor)	MISC	Known	50		540 sq	No
Ceiling: Fiberglass Insulation	NON	Non-Suspect				
Ducts: Canvas Duct Tape - Tan	MISC	None Detected	51	51C	140 ln	
Pipes: Fiberglass Pipe Wrap - 6" w/ Hard Elbow <i>Comment: 12 Hard Elbows & Mudded Fiberglass TSI Present in Various Spots</i>	TSI	Known	48		80 ln	Yes
Pipes: Hardpack Pipe Wrap - 6"	TSI	Known	52		80 ln	No

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: *Main Building*

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
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<u>Building:</u> 04 - Building A	<u>Room:</u> 31 - Space 30 - Electrical - 36 x 9 x 12
Floor: Concrete (Main Buildings)	MISC None Detected 42 324 sq
Walls: Concrete (Main Buildings)	MISC None Detected 42 540 sq
Walls: Drywall - Smooth Texture (2nd Floor)	MISC Known 53 540 No
Ceiling: Fiberglass Insulation	NON Non-Suspect
Pipes: Fiberglass Pipe Wrap - 6" w/ Hard Elbow	TSI Known 48 30 In Yes
<i>Comment: 6 Hard Elbows & Mudded Fiberglass Throughout</i>	
Pipes: Hardpack Pipe Wrap - 6"	TSI Known 52 30 In Yes

<u>Building:</u> 04 - Building A	<u>Room:</u> 32 - Space 31 - Storage - 11 x 11 x 10
Floor: Concrete (Main Buildings)	MISC None Detected 42 121 sq
Walls: Concrete (Main Buildings)	MISC None Detected 42 220 sq
Walls: Drywall - Smooth Texture (2nd Floor)	MISC Known 53 220 sq No
Ceiling: Fiberglass Insulation	NON Non-Suspect
Ducts: Canvas Duct Tape - Tan	MISC None Detected 51 60 In
HVAC: Vibration Dampener - Black	MISC None Detected 45 1 ea
HVAC: Vibration Dampener - White	MISC None Detected 54 54B 1 ea

<u>Building:</u> 04 - Building A	<u>Room:</u> 33 - Space 29A - Server Room - 12 x 10 x 10
Floor: VFT & Mastic - 24" Dark Grey	MISC None Detected 55 55A, 55B, 55C 120 sq
Walls: Concrete (Main Buildings)	MISC None Detected 42 110 sq
Walls: Drywall - Knockdown Texture (2nd Floor)	MISC Known 50 330 sq No
Ceiling: Fiberglass Insulation	NON Non-Suspect
Pipes: Fiberglass Pipe Wrap - 4" w/ Hard Elbow	TSI Known 47 10 In Yes
<i>Comment: 1 Hard Elbow & Mudded Fiberglass in Various Locations</i>	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 04 - Building A

Building Comment: *Main Building*

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>04 - Building A</u>		Room: <u>34 - Space 28 - Conference Room - 48 x 20 x 12</u>				
Floor: Concrete (Main Buildings)	MISC	None Detected	42		960 sq	
Walls: Concrete (Main Buildings)	MISC	None Detected	42		1061 sq	
Walls: Drywall - Knockdown Texture (2nd Floor)	MISC	Known	50		571 sq	No
Ceiling: Fiberglass Insulation	NON	Non-Suspect				
Ducts: Canvas Duct Tape - Tan	MISC	None Detected	51	51B	90 ln	
Pipes: Fiberglass Pipe Wrap - 4" w/ Hard Elbow	TSI	Known	47		5 ln	Yes
<i>Comment: 2 Hard Elbows & Mudded Fiberglass Throughout</i>						

Building: <u>04 - Building A</u>		Room: <u>35 - Space 28A - Storage - 16 x 12 x 12</u>				
Floor: Concrete (Main Buildings)	MISC	None Detected	42		192 sq	
Walls: Concrete (Main Buildings)	MISC	None Detected	42		168 sq	
Walls: Drywall - Smooth Texture (2nd Floor)	MISC	Known	53		504 sq	No
Ceiling: Fiberglass Insulation	NON	Non-Suspect				
Ducts: Canvas Duct Tape - Tan	MISC	None Detected	51		20 ln	

Building: <u>04 - Building A</u>		Room: <u>36 - Space 27 - Mechanical Room - 18 x 12 x 10</u>				
Floor: Concrete (Main Buildings)	MISC	None Detected	42		216 sq	
Walls: Concrete (Main Buildings)	MISC	None Detected	42		450 sq	
Walls: Drywall - Smooth Texture (2nd Floor)	MISC	Known	53		150 sq	No
Ceiling: Fiberglass Insulation	NON	Non-Suspect				
Ducts: Canvas Duct Tape - Tan	MISC	None Detected	51	51A	90 ln	
Ducts: Duct Tape & Mastic - Grey	MISC	None Detected	56	56A	4 sq	
HVAC: Vibration Dampener - Black	MISC	None Detected	45	45B	2 ea	
HVAC: Vibration Dampener - White	MISC	None Detected	54	54A	2 ea	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 05 - Building B

Building Comment: *Bus Wash*

Materials		Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>05 - Building B</u>		Room: <u>01 - Exterior - 50 x 36 x 15</u>					
Walls:	Concrete (Main Buildings)	MISC	None Detected	42	42D, 42E	2580 sq	
Walls:	Expansion Joint	MISC	None Detected	64	64B	180 ln	
Ground:	Concrete Sidewalk	MISC	None Detected	1		150 sq	
Roofs:	Single-Ply Roofing - White	MISC	None Detected	41	01C	1800 sq	
Building: <u>05 - Building B</u>		Room: <u>02 - Space 32 - Office - 20 x 10 x 15</u>					
Floor:	Concrete (Main Buildings)	MISC	None Detected	42		200 sq	
Walls:	Concrete (Main Buildings)	MISC	None Detected	42		900 sq	
Ceiling:	Fiberglass Insulation	NON	Non-Suspect				
Building: <u>05 - Building B</u>		Room: <u>03 - Space 33 - Office - 30 x 10 x 15</u>					
Floor:	Concrete (Main Buildings)	MISC	None Detected	42		300 sq	
Walls:	Concrete (Main Buildings)	MISC	None Detected	42		1200 sq	
Ceiling:	Fiberglass Insulation	NON	Non-Suspect				
Building: <u>05 - Building B</u>		Room: <u>04 - Space 34 Bus Wash - 50 x 25 x 15</u>					
Floor:	Concrete (Main Buildings)	MISC	None Detected	42	42A, 42B	1250 sq	
Walls:	Concrete (Main Buildings)	MISC	None Detected	42		2250 sq	
Ceiling:	Fiberglass Insulation	NON	Non-Suspect				
Pipes:	Fiberglass Pipe Wrap	TSI	None Detected	43	43A, 43B, 43C	40 ln	

Functional Space Notes

Forensic Analytical Consulting Services, Inc.

Client: Washoe County School District

Site: Getto Transportation

HMS Project Number: PJ71737

Date of Inspection: August 10, 2022

Building: 06 - Storage Shed

Building Comment: *Between A & B*

Materials	Material Class	Percent Asbestos	Hmgns Matrl #	Sampled Here?	Footage Sq/Ln/Jnts	Friable? Yes/No
Building: <u>06 - Storage Shed</u>		Room: <u>01 - Exterior - 10 x 9 x 9</u>				
Walls: Wood	NON	Non-Suspect				
Roofs: Comp Shingle Roofing - Brown	MISC	None Detected	44	44A, 44B, 44C	90 sq	
Building: <u>06 - Storage Shed</u>		Room: <u>02 - Shed - 10 x 9 x 9</u>				
Floor: Wood	NON	Non-Suspect				
Walls: Wood	NON	Non-Suspect				
Ceiling: Wood	NON	Non-Suspect				

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
P.O. Box 576848
Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22
Contact: Danny Prado
Collected By: Danny Prado
Date(s) Collected: 08/10/22, 08/11/22
Job ID: Washoe County School District
Job Site: Getto Transportation
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Analysis Requested: **PLM with Dispersion Staining**
Turn Around Time: **5 DAY**
Laboratory: SGS Forensic Laboratories
Special Instructions: Please email results to dprado@forensicanalytical.com
Project ID / Job No: PJ71737
Bill to: Forensic Analytical Consulting Services, Inc.

Sample ID	Material Description / Location
PJ71737-1A	Concrete Sidewalk 01 - 200's Building, 01 - Exterior, S Side Center
PJ71737-1B	Concrete Sidewalk 02 - 300's Building, 01 - Exterior, S Side Center
PJ71737-1C	Concrete Sidewalk 04 - Building A, 01 - Exterior, S Side Center
PJ71737-2A	Metal Roof Sealant - Grey 01 - 200's Building, 01 - Exterior, E Side Center
PJ71737-2B	Metal Roof Sealant - Grey 01 - 200's Building, 01 - Exterior, SW Corner
PJ71737-2C	Metal Roof Sealant - Grey 03 - 400's Building, 01 - Exterior, N Side Center
PJ71737-3A	Concrete 01 - 200's Building, 01 - Exterior, NW Corner
PJ71737-3B	Concrete 01 - 200's Building, 01 - Exterior, SW Corner
PJ71737-3C	Concrete 01 - 200's Building, 01 - Exterior, SE Corner
PJ71737-3D	Concrete 01 - 200's Building, 03 - Space 200 - Storage, S Side Center
PJ71737-3E	Concrete 03 - 400's Building, 01 - Exterior, S Side Center
PJ71737-3F	Concrete 03 - 400's Building, 07 - Basement, Center of Space
PJ71737-3G	Concrete 02 - 300's Building, 02 - Space 303 - Repair Shop, SW Corner
PJ71737-4A	Doorframe Sealant - White 01 - 200's Building, 01 - Exterior, SW Corner
PJ71737-4B	Doorframe Sealant - White 01 - 200's Building, 01 - Exterior, SE at Door
PJ71737-4C	Doorframe Sealant - White 01 - 200's Building, 01 - Exterior, SE Corner
PJ71737-5A	Penetration Mastic - White 01 - 200's Building, 01 - Exterior, S Side Center

Submitted By: 

Date Submitted: 8/12/22

Submitted Via: Fedex

Received By: 

Date Received: 8/15/22

Received Via: P/C 1134

a-25 Av

Date Printed: 8/12/2022

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
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Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22
Contact: Danny Prado
Collected By: Danny Prado
Date(s) Collected: 08/10/22, 08/11/22
Job ID: Washoe County School District
Job Site: Getto Transportation
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Analysis Requested: **PLM with Dispersion Staining**
Turn Around Time: **5 DAY**
Laboratory: SGS Forensic Laboratories
Special Instructions: Please email results to dprado@forensicanalytical.com
Project ID / Job No: PJ71737
Bill to: Forensic Analytical Consulting Services, Inc.

Sample ID	Material Description / Location
PJ71737-5B	Penetration Mastic - White 01 - 200's Building, 01 - Exterior, S Side Center
PJ71737-5C	Penetration Mastic - White 03 - 400's Building, 01 - Exterior, N Side Center
PJ71737-7A	Baseboard & Mastic - 4" Black 01 - 200's Building, 03 - Space 200 - Storage, NE Corner
PJ71737-7B	Baseboard & Mastic - 4" Black 01 - 200's Building, 03 - Space 200 - Storage, W Side Center
PJ71737-7C	Baseboard & Mastic - 4" Black 01 - 200's Building, 02 - Space 200A - Entry, W Side Center
PJ71737-9A	Drywall - Smooth Texture 01 - 200's Building, 04 - Space 201 - Restroom, SE Corner Comment: W/o Tape & JC
PJ71737-9B	Drywall - Smooth Texture 01 - 200's Building, 04 - Space 201 - Restroom, NE Corner Comment: W/ Tape & JC
PJ71737-9C	Drywall - Smooth Texture 01 - 200's Building, 04 - Space 201 - Restroom, SE Corner Comment: W/ Tape & JC
PJ71737-10A	Linoleum & Glue - Grey Pebble 01 - 200's Building, 04 - Space 201 - Restroom, NW Corner
PJ71737-10B	Linoleum & Glue - Grey Pebble 01 - 200's Building, 04 - Space 201 - Restroom, N Side W End
PJ71737-10C	Linoleum & Glue - Grey Pebble 01 - 200's Building, 04 - Space 201 - Restroom, SE Corner
PJ71737-11A	Baseboard & Mastic - 4" Grey 01 - 200's Building, 04 - Space 201 - Restroom, S Side Center
PJ71737-11B	Baseboard & Mastic - 4" Grey 01 - 200's Building, 04 - Space 201 - Restroom, E Side Center
PJ71737-11C	Baseboard & Mastic - 4" Grey 01 - 200's Building, 04 - Space 201 - Restroom, N Side Center
PJ71737-12A	CMU & Grout 02 - 300's Building, 01 - Exterior, NE Corner
PJ71737-12B	CMU & Grout 02 - 300's Building, 01 - Exterior, NW Corner
PJ71737-12C	CMU & Grout 03 - 400's Building, 01 - Exterior, SW Corner

Submitted By: 

Date Submitted: 8/12/22

Submitted Via: Fedex

Received By: 

Date Received: 8/15/22
9:25AM

Received Via: F/E 1139

Date Printed: 8/12/2022

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
P.O. Box 576848
Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22 Analysis Requested: **PLM with Dispersion Staining**
Contact: Danny Prado Turn Around Time: **5 DAY**
Collected By: Danny Prado Laboratory: SGS Forensic Laboratories
Date(s) Collected: 08/10/22, 08/11/22 Special Instructions: Please email results to
dprado@forensicanalytical.com
Job ID: Washoe County School District Project ID / Job No: PJ71737
Job Site: Getto Transportation Bill to: Forensic Analytical Consulting Services, Inc.
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Sample ID	Material Description / Location
PJ71737-13A	Comp Shingle Roofing - Grey 02 - 300's Building, 01 - Exterior, NW Corner Comment: Edge
PJ71737-13B	Comp Shingle Roofing - Grey 02 - 300's Building, 01 - Exterior, W Side Center Comment: Field
PJ71737-13C	Comp Shingle Roofing - Grey 02 - 300's Building, 01 - Exterior, Center of Roof Comment: Field
PJ71737-13D	Comp Shingle Roofing - Grey 02 - 300's Building, 01 - Exterior, SE Corner Comment: Edge
PJ71737-13E	Comp Shingle Roofing - Grey 03 - 400's Building, 01 - Exterior, N Side Center Comment: Edge
PJ71737-13F	Comp Shingle Roofing - Grey 03 - 400's Building, 01 - Exterior, Center of Roof
PJ71737-13G	Comp Shingle Roofing - Grey 03 - 400's Building, 01 - Exterior, South Side Center
PJ71737-14A	Frame Sealant - White 02 - 300's Building, 01 - Exterior, W Side S End at Window
PJ71737-14B	Frame Sealant - White 02 - 300's Building, 01 - Exterior, S Side Center at Door
PJ71737-14C	Frame Sealant - White 02 - 300's Building, 01 - Exterior, W Side Center
PJ71737-15A	Penetration Mastic - Grey 02 - 300's Building, 01 - Exterior, S Side E End
PJ71737-15B	Penetration Mastic - Grey 02 - 300's Building, 01 - Exterior, Center of Roof
PJ71737-15C	Penetration Mastic - Grey 02 - 300's Building, 01 - Exterior, Center of Roof
PJ71737-16A	Patch Mastic - Black 02 - 300's Building, 01 - Exterior, NW Corner
PJ71737-16B	Patch Mastic - Black 02 - 300's Building, 01 - Exterior, NW Corner
PJ71737-16C	Patch Mastic - Black 03 - 400's Building, 01 - Exterior, Center of Roof

Submitted By: 

Date Submitted: 8/12/22

Submitted Via: Fedex

Received By: 

Date Received: 8/15/22
9:25 AM

Received Via: F/E 1134

Date Printed: 8/12/2022

3 of 11

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
P.O. Box 576848
Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22 Analysis Requested: **PLM with Dispersion Staining**
Contact: Danny Prado Turn Around Time: **5 DAY**
Collected By: Danny Prado Laboratory: SGS Forensic Laboratories
Date(s) Collected: 08/10/22, 08/11/22 Special Instructions: Please email results to dprado@forensicanalytical.com
Job ID: Washoe County School District Project ID / Job No: PJ71737
Job Site: Getto Transportation Bill to: Forensic Analytical Consulting Services, Inc.
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Sample ID	Material Description / Location
PJ71737-17A	Drywall - Stipple Texture 02 - 300's Building, 10 - Space 300 - Vehicle Maintenance, South Side Center Comment: W/o Tape & JC
PJ71737-17B	Drywall - Stipple Texture 02 - 300's Building, 02 - Space 303 - Repair Shop, NE Corner Comment: W/ Tape & JC
PJ71737-17C	Drywall - Stipple Texture 02 - 300's Building, 02 - Space 303 - Repair Shop, NW Corner Comment: W/ Tape & JC
PJ71737-17D	Drywall - Stipple Texture 02 - 300's Building, 04 - Space 305 - Restroom, NE Corner Comment: W/ Tape & JC
PJ71737-17E	Drywall - Stipple Texture 02 - 300's Building, 08 - Space 309 - Storage, NW Corner Comment: W/ Tape & JC
PJ71737-18A	FCP - 2' x 2' Pinhole Fissure 02 - 300's Building, 02 - Space 303 - Repair Shop, Center of Space
PJ71737-18B	FCP - 2' x 2' Pinhole Fissure 02 - 300's Building, 02 - Space 303 - Repair Shop, SW Corner
PJ71737-18C	FCP - 2' x 2' Pinhole Fissure 02 - 300's Building, 08 - Space 309 - Storage, NE Corner
PJ71737-20A	VFT & Mastic - 12" White-Blue Oatmeal 02 - 300's Building, 03 - Restroom Hall, West Side Center
PJ71737-20B	VFT & Mastic - 12" White-Blue Oatmeal 02 - 300's Building, 06 - Space 307 - Storage, N Side E End
PJ71737-20C	VFT & Mastic - 12" White-Blue Oatmeal 02 - 300's Building, 06 - Space 307 - Storage, S Side Center
PJ71737-21A	VFT & Mastic - 12" Dark Grey 02 - 300's Building, 04 - Space 305 - Restroom, NE Corner
PJ71737-21B	VFT & Mastic - 12" Dark Grey 02 - 300's Building, 04 - Space 305 - Restroom, NW Corner
PJ71737-21C	VFT & Mastic - 12" Dark Grey 02 - 300's Building, 05 - Space 306 - Restroom, NE Corner
PJ71737-22A	Restroom Sealant - White 02 - 300's Building, 05 - Space 306 - Restroom, W Side N End
PJ71737-22B	Restroom Sealant - White 03 - 400's Building, 13 - Space 409 - Restroom, E Side Center

Submitted By: 
Received By: 

Date Submitted: 8/12/22
Date Received: 8/15/22
9:25 AM

Submitted Via: Fedex
Received Via: F/E 1134

Date Printed: 8/12/2022

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
P.O. Box 576848
Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22 Analysis Requested: **PLM with Dispersion Staining**
Contact: Danny Prado Turn Around Time: **5 DAY**
Collected By: Danny Prado Laboratory: SGS Forensic Laboratories
Date(s) Collected: 08/10/22, 08/11/22 Special Instructions: Please email results to dprado@forensicanalytical.com
Job ID: Washoe County School District Project ID / Job No: PJ71737
Job Site: Getto Transportation Bill to: Forensic Analytical Consulting Services, Inc.
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Sample ID	Material Description / Location
PJ71737-22C	Restroom Sealant - White 04 - Building A, 18 - Space 19 - Men's Restroom, S Side Center
PJ71737-23A	Drywall - Unfinished 02 - 300's Building, 10 - Space 300 - Vehicle Maintenance, S Side Center
PJ71737-23B	Drywall - Unfinished 02 - 300's Building, 06 - Space 307 - Storage, Center of Space
PJ71737-23C	Drywall - Unfinished 02 - 300's Building, 06 - Space 307 - Storage, W Side Center
PJ71737-24A	Drywall - Tape & Joint 02 - 300's Building, 06 - Space 307 - Storage, N Side Center
PJ71737-24B	Drywall - Tape & Joint 02 - 300's Building, 06 - Space 307 - Storage, N Side Center
PJ71737-24C	Drywall - Tape & Joint 02 - 300's Building, 06 - Space 307 - Storage, N Side Center
PJ71737-25A	VFT & Mastic - 24" Grey Pebble 02 - 300's Building, 07 - Space 308 - Storage, SW Corner
PJ71737-25B	VFT & Mastic - 24" Grey Pebble 02 - 300's Building, 07 - Space 308 - Storage, SE Corner
PJ71737-25C	VFT & Mastic - 24" Grey Pebble 02 - 300's Building, 07 - Space 308 - Storage, NE Corner
PJ71737-27A	Expansion Joint - Grey 02 - 300's Building, 10 - Space 300 - Vehicle Maintenance, Center of Space
PJ71737-27B	Expansion Joint - Grey 02 - 300's Building, 10 - Space 300 - Vehicle Maintenance, N Side Center
PJ71737-27C	Expansion Joint - Grey 02 - 300's Building, 10 - Space 300 - Vehicle Maintenance, S Side Center
PJ71737-28A	Fiberglass Batts w/ Paper 02 - 300's Building, 10 - Space 300 - Vehicle Maintenance, S Side Center
PJ71737-28B	Fiberglass Batts w/ Paper 02 - 300's Building, 13 - Attic, W Side Center
PJ71737-28C	Fiberglass Batts w/ Paper 02 - 300's Building, 13 - Attic, East Side Center
PJ71737-29A	Carpet & Mastic - Tan Squares 03 - 400's Building, 02 - Space 400 - Offices, NE Corner

Submitted By: 

Date Submitted: 8/12/22

Submitted Via: Fedex

Received By: 

Date Received: 8/15/22

Received Via: F/E 1134

Date Printed: 8/12/2022

Bulk Material Analysis Request Form

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Modesto, CA 95355-1755
(209) 551 - 2000
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Date Submitted: 08/12/22
Contact: Danny Prado
Collected By: Danny Prado
Date(s) Collected: 08/10/22, 08/11/22

Job ID: Washoe County School District
Job Site: Getto Transportation
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Analysis Requested: **PLM with Dispersion Staining**
Turn Around Time: **5 DAY**
Laboratory: SGS Forensic Laboratories
Special Instructions: Please email results to
dprado@forensicanalytical.com
Project ID / Job No: PJ71737
Bill to: Forensic Analytical Consulting Services, Inc.

Sample ID	Material Description / Location
PJ71737-29B	Carpet & Mastic - Tan Squares 03 - 400's Building, 04 - Space 402 - Storage, E Side Center at Door
PJ71737-29C	Carpet & Mastic - Tan Squares 03 - 400's Building, 08 - Space 405 - Dispatch, SE Corner at Door
PJ71737-30A	Drywall - Orange Peel Texture 03 - 400's Building, 02 - Space 400 - Offices, NW Corner Comment: W/ Tape & JC
PJ71737-30B	Drywall - Orange Peel Texture 03 - 400's Building, 02 - Space 400 - Offices, NE Corner Comment: W/ Tape & JC
PJ71737-30C	Drywall - Orange Peel Texture 03 - 400's Building, 03 - Space 401 - Hallway, SE Corner Comment: W/ Tape & JC
PJ71737-30D	Drywall - Orange Peel Texture 03 - 400's Building, 04 - Space 402 - Storage, NE Corner Comment: W/ Tape & JC
PJ71737-30E	Drywall - Orange Peel Texture 03 - 400's Building, 05 - Space 403 - Conference, SW Corner Comment: W/ Tape & JC
PJ71737-31A	VSF & Glue - Faux Wood 03 - 400's Building, 05 - Space 403 - Conference, S Side W End
PJ71737-31B	VSF & Glue - Faux Wood 03 - 400's Building, 15 - Space 412 - Storage, SW Corner
PJ71737-31C	VSF & Glue - Faux Wood 03 - 400's Building, 14 - Space 410/411 - Restroom, SW Corner
PJ71737-32A	Drywall - Heavy Knockdown Texture 03 - 400's Building, 06 - Space 404 - Copy Room, NW Corner Comment: W/ Tape & JC
PJ71737-32B	Drywall - Heavy Knockdown Texture 03 - 400's Building, 06 - Space 404 - Copy Room, SW Corner Comment: W/ Tape & JC
PJ71737-32C	Drywall - Heavy Knockdown Texture 03 - 400's Building, 06 - Space 404 - Copy Room, NE Corner Comment: W/ Tape & JC
PJ71737-33A	Wood Panels w/ Texture 03 - 400's Building, 12 - Space 408 - Utility, E Side S End
PJ71737-33B	Wood Panels w/ Texture 03 - 400's Building, 12 - Space 408 - Utility, E Side S End
PJ71737-33C	Wood Panels w/ Texture 03 - 400's Building, 09 - Space 406 - Entry, S Side E End
PJ71737-33D	Wood Panels w/ Texture 03 - 400's Building, 09 - Space 406 - Entry, S Side Center

Submitted By: 

Date Submitted: 8/12/22

Submitted Via: FedEx

Received By: 

Date Received: 8/15/22

Received Via: FEI1134

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Date Printed: 8/12/2022

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
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Modesto, CA 95355-1755
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FAX: (209) 575 - 5657

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Date(s) Collected: 08/10/22, 08/11/22

Job ID: Washoe County School District
Job Site: Getto Transportation
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Analysis Requested: **PLM with Dispersion Staining**

Turn Around Time: **5 DAY**

Laboratory: SGS Forensic Laboratories

Special Instructions: Please email results to
dprado@forensicanalytical.com

Project ID / Job No: PJ71737

Bill to: Forensic Analytical Consulting Services, Inc.

Sample ID	Material Description / Location
PJ71737-33E	Wood Panels w/ Texture 03 - 400's Building, 15 - Space 412 - Storage, S Side Center
PJ71737-34A	Laminate Flooring & Glue 03 - 400's Building, 13 - Space 409 - Restroom, SW Corner
PJ71737-34B	Laminate Flooring & Glue 03 - 400's Building, 13 - Space 409 - Restroom, SW Corner
PJ71737-34C	Laminate Flooring & Glue 03 - 400's Building, 14 - Space 410/411 - Restroom, W Side N End
PJ71737-35A	Mastic - Black 03 - 400's Building, 12 - Space 408 - Utility, W Side Center
PJ71737-35B	Mastic - Black 03 - 400's Building, 12 - Space 408 - Utility, S Side Center
PJ71737-35C	Mastic - Black 03 - 400's Building, 12 - Space 408 - Utility, Center of Space
PJ71737-36A	Foil Tape & Glue 03 - 400's Building, 12 - Space 408 - Utility, Center of Space
PJ71737-37A	HVAC Mastic - Grey 03 - 400's Building, 12 - Space 408 - Utility, Center of Space
PJ71737-38A	Siding Sealant - White 03 - 400's Building, 01 - Exterior, E Side Center
PJ71737-38B	Siding Sealant - White 03 - 400's Building, 01 - Exterior, E Side S End
PJ71737-38C	Siding Sealant - White 03 - 400's Building, 01 - Exterior, W Side S End
PJ71737-39A	Windowframe Sealant - Black 03 - 400's Building, 01 - Exterior, S Side Center
PJ71737-39B	Windowframe Sealant - Black 03 - 400's Building, 01 - Exterior, S Side E End
PJ71737-39C	Windowframe Sealant - Black 03 - 400's Building, 01 - Exterior, N Side Center
PJ71737-42A	Concrete (Main Buildings) 05 - Building B, 04 - Space 34 Bus Wash, Center of Space
PJ71737-42B	Concrete (Main Buildings) 05 - Building B, 04 - Space 34 Bus Wash, N Side Center

Submitted By: 

Date Submitted: 8/12/22

Submitted Via: FedEx

Received By: 

Date Received: 8/15/22

Received Via: P/C 1139

9:25 AM

Date Printed: 8/12/2022

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

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Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22 Analysis Requested: **PLM with Dispersion Staining**
Contact: Danny Prado Turn Around Time: **5 DAY**
Collected By: Danny Prado Laboratory: SGS Forensic Laboratories
Date(s) Collected: 08/10/22, 08/11/22 Special Instructions: Please email results to dprado@forensicanalytical.com
Job ID: Washoe County School District Project ID / Job No: PJ71737
Job Site: Getto Transportation Bill to: Forensic Analytical Consulting Services, Inc.
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Sample ID	Material Description / Location
PJ71737-42C	Concrete (Main Buildings) 04 - Building A, 21 - Space 26 - Garage, E Side N End
PJ71737-42D	Concrete (Main Buildings) 05 - Building B, 01 - Exterior, W Side Center
PJ71737-42E	Concrete (Main Buildings) 05 - Building B, 01 - Exterior, N Side Center
PJ71737-43A	Fiberglass Pipe Wrap 05 - Building B, 04 - Space 34 Bus Wash, W Side Center
PJ71737-43B	Fiberglass Pipe Wrap 05 - Building B, 04 - Space 34 Bus Wash, W Side Center
PJ71737-43C	Fiberglass Pipe Wrap 05 - Building B, 04 - Space 34 Bus Wash, W Side Center
PJ71737-44A	Comp Shingle Roofing - Brown 06 - Storage Shed, 01 - Exterior, E Side S End
PJ71737-44B	Comp Shingle Roofing - Brown 06 - Storage Shed, 01 - Exterior, SE Corner
PJ71737-44C	Comp Shingle Roofing - Brown 06 - Storage Shed, 01 - Exterior, NE Corner
PJ71737-45A	Vibration Dampener - Black 04 - Building A, 21 - Space 26 - Garage, NE Corner
PJ71737-45B	Vibration Dampener - Black 04 - Building A, 36 - Space 27 - Mechanical Room, Center of Space
PJ71737-46A	Expansion Joint - White 04 - Building A, 21 - Space 26 - Garage, W Side Center
PJ71737-46B	Expansion Joint - White 04 - Building A, 21 - Space 26 - Garage, Center of Space
PJ71737-46C	Expansion Joint - White 04 - Building A, 21 - Space 26 - Garage, W Side S End
PJ71737-51A	Canvas Duct Tape - Tan 04 - Building A, 36 - Space 27 - Mechanical Room, N Side Center
PJ71737-51B	Canvas Duct Tape - Tan 04 - Building A, 34 - Space 28 - Conference Room, N Side Center
PJ71737-51C	Canvas Duct Tape - Tan 04 - Building A, 30 - Space 29 - Loft Break Room, SE Corner

Submitted By: 
Received By: 

Date Submitted: 8/12/22 Submitted Via: Fedex
Date Received: 8/15/22 Received Via: F/E 1134
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Date Printed: 8/12/2022

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Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
P.O. Box 576848
Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22
Contact: Danny Prado
Collected By: Danny Prado
Date(s) Collected: 08/10/22, 08/11/22
Job ID: Washoe County School District
Job Site: Getto Transportation
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Analysis Requested: **PLM with Dispersion Staining**
Turn Around Time: **5 DAY**
Laboratory: SGS Forensic Laboratories
Special Instructions: Please email results to dprado@forensicanalytical.com
Project ID / Job No: PJ71737
Bill to: Forensic Analytical Consulting Services, Inc.

Sample ID	Material Description / Location
PJ71737-54A	Vibration Dampener - White 04 - Building A, 36 - Space 27 - Mechanical Room, Center of Space
PJ71737-54B	Vibration Dampener - White 04 - Building A, 32 - Space 31 - Storage, Center of Space
PJ71737-55A	VFT & Mastic - 24" Dark Grey 04 - Building A, 33 - Space 29A - Server Room, NE Corner
PJ71737-55B	VFT & Mastic - 24" Dark Grey 04 - Building A, 33 - Space 29A - Server Room, SW Corner
PJ71737-55C	VFT & Mastic - 24" Dark Grey 04 - Building A, 33 - Space 29A - Server Room, Center of Space
PJ71737-56A	Duct Tape & Mastic - Grey 04 - Building A, 36 - Space 27 - Mechanical Room, Center of Space
PJ71737-57A	Carpet & Mastic - Grey Multi 04 - Building A, 12 - Space 12 - Office, S Side W End at Door
PJ71737-57B	Carpet & Mastic - Grey Multi 04 - Building A, 12 - Space 12 - Office, E Side N End
PJ71737-57C	Carpet & Mastic - Grey Multi 04 - Building A, 02 - Space 1A - Admin Lobby, E Side Center
PJ71737-58A	Baseboard & Mastic - 4" Black (MB) 04 - Building A, 19 - Space 17 - Office, W Side S End
PJ71737-58B	Baseboard & Mastic - 4" Black (MB) 04 - Building A, 22 - Space 15 - Parts Storage, S Side Center
PJ71737-58C	Baseboard & Mastic - 4" Black (MB) 04 - Building A, 07 - Space 4A - Main Entry, W Side S End
PJ71737-59A	Drywall - Knockdown Texture (1st Floor) 04 - Building A, 28 - Locker Room Closet, W Side Center Comment: W/o Tape & JC
PJ71737-59B	Drywall - Knockdown Texture (1st Floor) 04 - Building A, 28 - Locker Room Closet, NE Corner Comment: W/ Tape & JC
PJ71737-59C	Drywall - Knockdown Texture (1st Floor) 04 - Building A, 28 - Locker Room Closet, NW Corner Comment: W/ Tape & JC
PJ71737-59D	Drywall - Knockdown Texture (1st Floor) 04 - Building A, 27 - Space 22 - Locker Room, NE Corner Comment: W/ Tape & JC
PJ71737-59E	Drywall - Knockdown Texture (1st Floor) 04 - Building A, 07 - Space 4A - Main Entry, NW Corner Comment: W/ Tape & JC

Submitted By: 

Date Submitted: 8/12/22

Submitted Via: Fedex

Received By: 

Date Received: 8/15/22
9:25 AM

Received Via: FIE 1134

Date Printed: 8/12/2022

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
P.O. Box 576848
Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22
Contact: Danny Prado
Collected By: Danny Prado
Date(s) Collected: 08/10/22, 08/11/22
Job ID: Washoe County School District
Job Site: Getto Transportation
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Analysis Requested: **PLM with Dispersion Staining**
Turn Around Time: **5 DAY**
Laboratory: SGS Forensic Laboratories
Special Instructions: Please email results to dprado@forensicanalytical.com
Project ID / Job No: PJ71737
Bill to: Forensic Analytical Consulting Services, Inc.

Sample ID	Material Description / Location
PJ71737-59F	Drywall - Knockdown Texture (1st Floor) 04 - Building A, 20 - Space 16 - Office, SW Corner Comment: W/ Tape & JC
PJ71737-59G	Drywall - Knockdown Texture (1st Floor) 04 - Building A, 19 - Space 17 - Office, NE Corner Comment: W/ Tape & JC
PJ71737-60A	FCP - 2' x 4' Pinhole Fissure 04 - Building A, 02 - Space 1A - Admin Lobby, W Side Center
PJ71737-60B	FCP - 2' x 4' Pinhole Fissure 04 - Building A, 04 - Space 11 - Hallway, W Side Center
PJ71737-60C	FCP - 2' x 4' Pinhole Fissure 04 - Building A, 07 - Space 4A - Main Entry, S Side E End
PJ71737-61A	Concrete w/Texture 04 - Building A, 03 - Space 1 - Open Area, NE Corner
PJ71737-61B	Concrete w/Texture 04 - Building A, 04 - Space 11 - Hallway, N Side E End
PJ71737-61C	Concrete w/Texture 04 - Building A, 14 - Space 21A - Women's RR Foyer, S Side Center
PJ71737-61D	Concrete w/Texture 04 - Building A, 04 - Space 11 - Hallway, NW Corner
PJ71737-61E	Concrete w/Texture 04 - Building A, 02 - Space 1A - Admin Lobby, N Side E End
PJ71737-62A	VFT & Mastic - 24" Light Grey Pebble 04 - Building A, 03 - Space 1 - Open Area, NW Corner
PJ71737-62B	VFT & Mastic - 24" Light Grey Pebble 04 - Building A, 17 - Space 19A - Mens RR Foyer, N Side Center
PJ71737-62C	VFT & Mastic - 24" Light Grey Pebble 04 - Building A, 07 - Space 4A - Main Entry, S Side W End
PJ71737-63A	Drywall - Smooth Texture (1st Floor) 04 - Building A, 24 - Space 13 - Haz Storage, SE Corner Comment: W/ Tape & JC
PJ71737-63B	Drywall - Smooth Texture (1st Floor) 04 - Building A, 24 - Space 13 - Haz Storage, SW Corner Comment: W/ Tape & JC
PJ71737-63C	Drywall - Smooth Texture (1st Floor) 04 - Building A, 24 - Space 13 - Haz Storage, SE Corner Comment: W/ Tape & JC
PJ71737-64A	Expansion Joint 04 - Building A, 01 - Exterior, E Side Center

Submitted By: 

Date Submitted: 8/12/22

Submitted Via: Fedex

Received By: 

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9:25 AM

Date Printed: 8/12/2022

Bulk Material Analysis Request Form

Forensic Analytical Consulting Services, Inc.

Modesto
P.O. Box 576848
Modesto, CA 95355-1755
(209) 551 - 2000
FAX: (209) 575 - 5657

Date Submitted: 08/12/22 Analysis Requested: **PLM with Dispersion Staining**
Contact: Danny Prado Turn Around Time: **5 DAY**
Collected By: Danny Prado Laboratory: SGS Forensic Laboratories
Date(s) Collected: 08/10/22, 08/11/22 Special Instructions: Please email results to dprado@forensicanalytical.com
Job ID: Washoe County School District Project ID / Job No: PJ71737
Job Site: Getto Transportation Bill to: Forensic Analytical Consulting Services, Inc.
Site Address: 1850 Kleppe Lane, Sparks, NV 89431

Sample ID	Material Description / Location
PJ71737-64B	Expansion Joint 05 - Building B, 01 - Exterior, W Side Center
PJ71737-64C	Expansion Joint 04 - Building A, 21 - Space 26 - Garage, E Side Center
PJ71737-65A	Epoxy - Grey Pebble 04 - Building A, 18 - Space 19 - Men's Restroom, E Side Center
PJ71737-65B	Epoxy - Grey Pebble 04 - Building A, 18 - Space 19 - Men's Restroom, E Side N End
PJ71737-65C	Epoxy - Grey Pebble 04 - Building A, 27 - Space 22 - Locker Room, NE Corner
PJ71737-66A	FRP & Glue - White 04 - Building A, 16 - Space 18C - Custodial, E Side Center
PJ71737-66B	FRP & Glue - White 04 - Building A, 16 - Space 18C - Custodial, East Side Center
PJ71737-66C	FRP & Glue - White 04 - Building A, 16 - Space 18C - Custodial, East Side Center
PJ71737-67A	VFT & Mastic - 12" Beige Oatmeal 04 - Building A, 25 - Space 24 - Stair Entry, NE Corner
PJ71737-67B	VFT & Mastic - 12" Beige Oatmeal 04 - Building A, 25 - Space 24 - Stair Entry, NW Corner
PJ71737-67C	VFT & Mastic - 12" Beige Oatmeal 04 - Building A, 25 - Space 24 - Stair Entry, S Side Center
PJ71737-69A	Frame Sealant - Tan 04 - Building A, 01 - Exterior, S Side Center
PJ71737-69B	Frame Sealant - Tan 04 - Building A, 01 - Exterior, S Side Center
PJ71737-69C	Frame Sealant - Tan 04 - Building A, 01 - Exterior, S Side Center

Submitted By: 

Date Submitted: 8/12/22

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Date Printed: 8/12/2022

Bulk Asbestos Analysis

(EPA Method 40CFR, Part 763, Appendix E to Subpart E and EPA 600/R-93-116, Visual Area Estimation)

NVLAP Lab Code: 101459-1

FACS - Modesto
Daniel Prado
21228 Cabot Blvd.

Hayward, CA 94545

Client ID: MOD08
Report Number: B337122
Date Received: 08/15/22
Date Analyzed: 08/22/22
Date Printed: 08/22/22
First Reported: 08/22/22

Job ID/Site: PJ71737; Washoe County School District - Capital Projects & Planning Getto
Transportation 1850 Kleppe Lane Sparks NV
Date(s) Collected: 08/12/2022

SGSFL Job ID: MOD08
Total Samples Submitted: 182
Total Samples Analyzed: 182

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-1A	51579622						
Layer: Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-1B	51579623						
Layer: Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-1C	51579624						
Layer: Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-2A	51579625						
Layer: Grey Non-Fibrous Material			ND				
Layer: Clear Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-2B	51579626						
Layer: Tan Fibrous Material			ND				
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-2C	51579627						
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-3A	51579628						
Layer: Grey Cementitious Material			ND				
Layer: Paint/Coating			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							

Client Name: FACS - Modesto**Report Number:** B337122**Date Printed:** 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-3B	51579629						
Layer: Grey Cementitious Material			ND				
Layer: Paint/Coating			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-3C	51579630						
Layer: Grey Cementitious Material			ND				
Layer: Paint/Coating			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-3D	51579631						
Layer: Black/Tan Mastic		Chrysotile	2 %				
Layer: Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-3E	51579632						
Layer: Grey Cementitious Material			ND				
Layer: Paint/Coating			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-3F	51579633						
Layer: Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-3G	51579634						
Layer: Grey Cementitious Material			ND				
Layer: Paint/Coating			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-4A	51579635						
Layer: Tan Fibrous Material			ND				
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-4B	51579636						
Layer: Tan Fibrous Material			ND				
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							

Client Name: FACS - Modesto

Report Number: B337122

Date Printed: 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-4C	51579637						
Layer: Tan Fibrous Material			ND				
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-5A	51579638						
Layer: Black Mastic		Chrysotile	3 %				
Layer: White Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-5B	51579639						
Layer: White Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-5C	51579640						
Layer: Black Felt			ND				
Layer: White Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-7A	51579641						
Layer: Black Non-Fibrous Material			ND				
Layer: Off-White Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-7B	51579642						
Layer: Black Non-Fibrous Material			ND				
Layer: Off-White Mastic			ND				
Layer: Paint			ND				
Layer: Off-White Joint Compound			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-7C	51579643						
Layer: Black Non-Fibrous Material			ND				
Layer: Off-White Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-9A	51579644						
Layer: White Drywall			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (15 %) Fibrous Glass (Trace)							

Client Name: FACS - Modesto

Report Number: B337122

Date Printed: 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-9B	51579645						
Layer: White Drywall			ND				
Layer: Beige Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: Beige Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (25 %) Fibrous Glass (Trace)							
PJ71737-9C	51579646						
Layer: White Drywall			ND				
Layer: Beige Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: Beige Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (25 %) Fibrous Glass (Trace)							
PJ71737-10A	51579647						
Layer: Grey Sheet Flooring			ND				
Layer: Fibrous Backing			ND				
Layer: Yellow Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)							
PJ71737-10B	51579648						
Layer: Grey Sheet Flooring			ND				
Layer: Fibrous Backing			ND				
Layer: Yellow Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)							
PJ71737-10C	51579649						
Layer: Grey Sheet Flooring			ND				
Layer: Fibrous Backing			ND				
Layer: Yellow Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)							
PJ71737-11A	51579650						
Layer: Grey Non-Fibrous Material			ND				
Layer: Beige Mastic			ND				
Layer: Paint			ND				
Layer: Drywall Backing			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (3 %)							

Client Name: FACS - Modesto

Report Number: B337122

Date Printed: 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-11B	51579651						
Layer: Grey Non-Fibrous Material			ND				
Layer: Beige Mastic			ND				
Layer: Paint			ND				
Layer: Drywall Backing			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (3 %)							
PJ71737-11C	51579652						
Layer: Grey Non-Fibrous Material			ND				
Layer: Beige Mastic			ND				
Layer: Paint			ND				
Layer: Yellow Mastic			ND				
Layer: Drywall Backing			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (3 %)							
PJ71737-12A	51579653						
Layer: Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-12B	51579654						
Layer: Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-12C	51579655						
Layer: Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-13A	51579656						
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (40 %) Fibrous Glass (35 %)							
PJ71737-13B	51579657						
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (40 %) Fibrous Glass (35 %)							

Client Name: FACS - Modesto

Report Number: B337122

Date Printed: 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-13C	51579658						
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (40 %)	Fibrous Glass (35 %)						
PJ71737-13D	51579659						
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (30 %)						
PJ71737-13E	51579660						
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (30 %)						
PJ71737-13F	51579661						
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (30 %)						
PJ71737-13G	51579662						
Layer: Stones			ND				
Layer: Black Tar			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (30 %)						
PJ71737-14A	51579663						
Layer: Wood			ND				
Layer: Clear Non-Fibrous Material			ND				
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (40 %)							
PJ71737-14B	51579664						
Layer: Paints			ND				
Layer: Grey Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							

Client Name: FACS - Modesto

Report Number: B337122

Date Printed: 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-14C	51579665						
Layer: Wood			ND				
Layer: Clear Non-Fibrous Material			ND				
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (25 %)							
PJ71737-15A	51579666						
Layer: Black Semi-Fibrous Tar			ND				
Layer: Grey Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-15B	51579667						
Layer: Black Semi-Fibrous Tar			ND				
Layer: Grey Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (2 %)							
PJ71737-15C	51579668						
Layer: Black Semi-Fibrous Tar			ND				
Layer: Grey Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (2 %)							
PJ71737-16A	51579669						
Layer: Black Semi-Fibrous Tar			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (5 %)							
PJ71737-16B	51579670						
Layer: Black Semi-Fibrous Tar			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (5 %)							
PJ71737-16C	51579671						
Layer: Black Semi-Fibrous Tar			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (5 %)							
PJ71737-17A	51579672						
Layer: White Drywall			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (15 %) Fibrous Glass (Trace)							

Client Name: FACS - Modesto

Report Number: B337122

Date Printed: 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-17B	51579673						
Layer: White Drywall			ND				
Layer: Beige Joint Compound		Chrysotile	2 %				
Layer: Drywall Tape			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (Trace)						
PJ71737-17C	51579674						
Layer: White Drywall			ND				
Layer: Beige Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: Beige Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (25 %)	Fibrous Glass (Trace)						
PJ71737-17D	51579675						
Layer: Wood			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (95 %)							
PJ71737-17E	51579676						
Layer: Wood			ND				
Layer: White Drywall			ND				
Layer: Beige Joint Compound		Chrysotile	Trace				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (Trace)						
Comment: This comment applies to the Beige Joint Compound layer only: Insufficient material for additional analyses.							
PJ71737-18A	51579677						
Layer: Grey Fibrous Tile			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (2 %)	Fibrous Glass (90 %)						
PJ71737-18B	51579678						
Layer: Grey Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (45 %)						
PJ71737-18C	51579679						
Layer: Grey Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (45 %)						

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-20A	51579680						
Layer: Off-White Tile			ND				
Layer: Yellow Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-20B	51579681						
Layer: Off-White Tile			ND				
Layer: Yellow Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-20C	51579682						
Layer: Off-White Tile			ND				
Layer: Yellow Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-21A	51579683						
Layer: Grey Tile			ND				
Layer: Yellow Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-21B	51579684						
Layer: Grey Tile			ND				
Layer: Yellow Mastic			ND				
Layer: Paints			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-21C	51579685						
Layer: Grey Tile			ND				
Layer: Yellow Mastic			ND				
Layer: Paint			ND				
Layer: Yellow Mastic			ND				
Layer: Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-22A	51579686						
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-22B	51579687						
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-22C	51579688						
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-23A	51579689						
Layer: White Drywall Panel			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (10 %) Fibrous Glass (Trace)							
PJ71737-23B	51579690						
Layer: White Drywall Panel			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (10 %) Fibrous Glass (Trace)							
PJ71737-23C	51579691						
Layer: White Drywall Panel			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (10 %) Fibrous Glass (Trace)							
PJ71737-24A	51579692						
Layer: White Drywall			ND				
Layer: White Woven Material			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (15 %) Fibrous Glass (Trace)							
PJ71737-24B	51579693						
Layer: Wood			ND				
Layer: White Drywall			ND				
Layer: White Woven Material			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (75 %) Fibrous Glass (Trace)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-24C	51579694						
Layer: White Drywall			ND				
Layer: White Woven Material			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (15 %) Fibrous Glass (Trace)							
PJ71737-25A	51579695						
Layer: Grey Flooring			ND				
Layer: Clear and Yellow Mastics with Debris			ND				
Layer: Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-25B	51579696						
Layer: Grey Flooring			ND				
Layer: Clear and Yellow Mastics with Debris			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-25C	51579697						
Layer: Grey Flooring			ND				
Layer: Clear and Yellow Mastics with Debris			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-27A	51579698						
Layer: Brown Fibrous Material with Debris			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (95 %)							
PJ71737-27B	51579699						
Layer: Brown Fibrous Material with Debris			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (95 %)							
PJ71737-27C	51579700						
Layer: Brown Fibrous Material with Debris			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (95 %)							
PJ71737-28A	51579701						
Layer: Pink Fibrous Material			ND				
Layer: Tan Fibrous Material with Foil			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (10 %) Fibrous Glass (80 %)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-28B	51579702						
Layer: Off-White Fibrous Material			ND				
Layer: Tan Fibrous Material with Foil			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (10 %)	Fibrous Glass (80 %)						
PJ71737-28C	51579703						
Layer: Pink Fibrous Material			ND				
Layer: Tan Fibrous Material with Foil			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (10 %)	Fibrous Glass (80 %)						
PJ71737-29A	51579704						
Layer: Tan Carpet			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Synthetic (85 %)						
PJ71737-29B	51579705						
Layer: Tan Carpet			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Synthetic (85 %)						
PJ71737-29C	51579706						
Layer: Tan Carpet			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Synthetic (85 %)						
PJ71737-30A	51579707						
Layer: White Drywall			ND				
Layer: Off-White Joint Compound	Chrysotile		2 %				
Layer: Paint			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)							
PJ71737-30B	51579708						
Layer: White Drywall			ND				
Layer: Off-White Joint Compound	Chrysotile		2 %				
Layer: Paint			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-30C	51579709						
Layer: White Drywall			ND				
Layer: Off-White Joint Compound		Chrysotile	2 %				
Layer: Paint			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)							
PJ71737-30D	51579710						
Layer: White Drywall			ND				
Layer: Off-White Joint Compound		Chrysotile	2 %				
Layer: Drywall Tape			ND				
Layer: Off-White Joint Compound		Chrysotile	2 %				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)							
PJ71737-30E	51579711						
Layer: White Drywall			ND				
Layer: Off-White Joint Compound		Chrysotile	2 %				
Layer: Paint			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)							
PJ71737-31A	51579712						
Layer: Brown Sheet Flooring			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-31B	51579713						
Layer: Brown Sheet Flooring			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-31C	51579714						
Layer: Brown Sheet Flooring			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-32A	51579715						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (20 %)							
PJ71737-32B	51579716						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (20 %)							
PJ71737-32C	51579717						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (20 %)							
PJ71737-33A	51579718						
Layer: Tan Fibrous Material			ND				
Layer: Paint			ND				
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (95 %)							
PJ71737-33B	51579719						
Layer: Tan Fibrous Material			ND				
Layer: Paint			ND				
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (95 %)							
PJ71737-33C	51579720						
Layer: Tan Fibrous Material			ND				
Layer: Paint			ND				
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (5 %)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-33D	51579721						
Layer: Tan Fibrous Material			ND				
Layer: Paint			ND				
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (95 %)							
PJ71737-33E	51579722						
Layer: Tan Fibrous Material			ND				
Layer: Paint			ND				
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (95 %)							
PJ71737-34A	51579723						
Layer: Beige Sheet Flooring			ND				
Layer: Fibrous Backing			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace) Fibrous Glass (2 %) Synthetic (7 %)							
PJ71737-34B	51579724						
Layer: Beige Sheet Flooring			ND				
Layer: Fibrous Backing			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace) Fibrous Glass (2 %) Synthetic (7 %)							
PJ71737-34C	51579725						
Layer: Red-Brown Sheet Flooring			ND				
Layer: Fibrous Backing/Tan Mastic		Chrysotile	70 %				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (5 %)							
PJ71737-35A	51579726						
Layer: Black Mastic with Debris		Chrysotile	2 %				
Layer: Wood			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (55 %)							
PJ71737-35B	51579727						
Layer: Black Mastic with Debris		Chrysotile	2 %				
Layer: Wood			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (10 %)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-35C	51579728						
Layer: Black Mastic with Debris		Chrysotile	2 %				
Layer: Wood			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (85 %)							
PJ71737-36A	51579729						
Layer: Foil with Adhesive			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-37A	51579730						
Layer: Foil with Adhesive			ND				
Layer: Grey Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-38A	51579731						
Layer: White Non-Fibrous Material w/ Debris			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-38B	51579732						
Layer: White Non-Fibrous Material w/ Debris			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-38C	51579733						
Layer: White Non-Fibrous Material w/ Debris			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-39A	51579734						
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-39B	51579735						
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-39C	51579736						
Layer: White Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-42A	51579737						
Layer: Dark Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-42B	51579738						
Layer: Dark Grey Cementitious Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-42C	51579739						
Layer: Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-42D	51579740						
Layer: Light Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-42E	51579741						
Layer: Light Grey Cementitious Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-43A	51579742						
Layer: Yellow Fibrous Material			ND				
Layer: Foil			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Fibrous Glass (95 %)							
PJ71737-43B	51579743						
Layer: Yellow Fibrous Material			ND				
Layer: Foil			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Fibrous Glass (95 %)							
PJ71737-43C	51579744						
Layer: Yellow Fibrous Material			ND				
Layer: Foil			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Fibrous Glass (95 %)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-44A	51579745						
Layer: Tan Roof Shingle			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (30 %)						
PJ71737-44B	51579746						
Layer: Tan Roof Shingle			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (30 %)						
PJ71737-44C	51579747						
Layer: Tan Roof Shingle			ND				
Layer: Black Felt			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (30 %)						
PJ71737-45A	51579748						
Layer: Black Semi-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Synthetic (25 %)						
PJ71737-45B	51579749						
Layer: Black Semi-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Synthetic (25 %)						
PJ71737-46A	51579750						
Layer: Grey Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-46B	51579751						
Layer: Grey Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-46C	51579752						
Layer: Grey Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-51A	51579753						
Layer: White Woven Material with Coating			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (85 %)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-51B	51579754						
Layer: White Woven Material with Coating			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (85 %)							
PJ71737-51C	51579755						
Layer: White Woven Material with Coating			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (85 %)							
PJ71737-54A	51579756						
Layer: Off-White Semi-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Fibrous Glass (45 %)							
PJ71737-54B	51579757						
Layer: Off-White Semi-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Fibrous Glass (45 %)							
PJ71737-55A	51579758						
Layer: Grey Tile			ND				
Layer: Dark Grey Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-55B	51579759						
Layer: Grey Tile			ND				
Layer: Dark Grey Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-55C	51579760						
Layer: Grey Tile			ND				
Layer: Dark Grey Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-56A	51579761						
Layer: Off-White Adhesive			ND				
Layer: Grey Duct Tape			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (15 %)							
PJ71737-57A	51579762						
Layer: Multi-Color Carpet with Pad			ND				
Layer: Clear Mastic with Debris			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Synthetic (40 %)							

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-57B	51579763						
Layer: Multi-Color Carpet with Pad			ND				
Layer: Clear Mastic with Debris			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Synthetic (40 %)						
PJ71737-57C	51579764						
Layer: Multi-Color Carpet with Pad			ND				
Layer: Clear Mastic with Debris			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Synthetic (40 %)						
PJ71737-58A	51579765						
Layer: Black Non-Fibrous Material			ND				
Layer: Off-White Mastic			ND				
Layer: Paint			ND				
Layer: White Joint Compound			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-58B	51579766						
Layer: Black Non-Fibrous Material			ND				
Layer: Off-White Mastic			ND				
Layer: Paint			ND				
Layer: White Semi-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Fibrous Glass (Trace)						
PJ71737-58C	51579767						
Layer: Black Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)	Fibrous Glass (Trace)						
PJ71737-59A	51579768						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (Trace)						
PJ71737-59B	51579769						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (Trace)						

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-59C	51579770						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (Trace)						
PJ71737-59D	51579771						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (Trace)						
PJ71737-59E	51579772						
Layer: White Drywall			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (Trace)						
PJ71737-59F	51579773						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (Trace)						
PJ71737-59G	51579774						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %)	Fibrous Glass (Trace)						
PJ71737-60A	51579775						
Layer: Beige Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (45 %)						
PJ71737-60B	51579776						
Layer: Beige Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (45 %)						

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Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-60C	51579777						
Layer: Beige Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (35 %)	Fibrous Glass (45 %)						
PJ71737-61A	51579778						
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-61B	51579779						
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-61C	51579780						
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-61D	51579781						
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-61E	51579782						
Layer: White Texture			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-62A	51579783						
Layer: Grey Tile			ND				
Layer: Tan Mastic			ND				
Layer: Grey Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-62B	51579784						
Layer: Grey Tile			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							

Client Name: FACS - Modesto

Report Number: B337122

Date Printed: 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-62C	51579785						
Layer: Grey Tile			ND				
Layer: Tan Mastic			ND				
Layer: Grey Non-Fibrous Material			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-63A	51579786						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %) Fibrous Glass (2 %)							
PJ71737-63B	51579787						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %) Fibrous Glass (Trace)							
PJ71737-63C	51579788						
Layer: White Drywall			ND				
Layer: White Joint Compound			ND				
Layer: Drywall Tape			ND				
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (20 %) Fibrous Glass (2 %)							
PJ71737-64A	51579789						
Layer: Grey Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							
PJ71737-64B	51579790						
Layer: Grey Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components:							
Cellulose (Trace)							

Client Name: FACS - Modesto**Report Number:** B337122**Date Printed:** 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-64C	51579791						
Layer: Grey Non-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-65A	51579792						
Layer: Grey Flooring			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-65B	51579793						
Layer: Grey Flooring			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-65C	51579794						
Layer: Grey Flooring			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-66A	51579795						
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Layer: Off-White Mastic			ND				
Layer: White Semi-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Fibrous Glass (20 %)							
PJ71737-66B	51579796						
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Layer: Off-White Mastic			ND				
Layer: White Semi-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Fibrous Glass (20 %)							
PJ71737-66C	51579797						
Layer: White Joint Compound			ND				
Layer: Paint			ND				
Layer: Off-White Mastic			ND				
Layer: White Semi-Fibrous Material			ND				
Layer: Paint			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace) Fibrous Glass (20 %)							

Client Name: FACS - Modesto

Report Number: B337122

Date Printed: 08/22/22

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ71737-67A	51579798						
Layer: Beige Tile			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-67B	51579799						
Layer: Beige Tile			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-67C	51579800						
Layer: Beige Tile			ND				
Layer: Tan Mastic			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-69A	51579801						
Layer: Clear Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-69B	51579802						
Layer: Clear Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							
PJ71737-69C	51579803						
Layer: Clear Non-Fibrous Material			ND				
Total Composite Values of Non-Asbestos Fibrous Components: Cellulose (Trace)							



Tiffani Ludd, Laboratory Supervisor, Carson Laboratory

Note: Limit of Quantification ('LOQ') = 1%. 'Trace' denotes the presence of asbestos below the LOQ. 'ND' = 'None Detected'.

Analytical results and reports are generated by SGS Forensic Laboratories (SGSFL) at the request of and for the exclusive use of the person or entity (client) named on such report. Results, reports or copies of same will not be released by SGSFL to any third party without prior written request from client. This report applies only to the sample(s) tested. Supporting laboratory documentation is available upon request. This report must not be reproduced except in full, unless approved by SGSFL. The client is solely responsible for the use and interpretation of test results and reports requested from SGSFL. SGSFL is not able to assess the degree of hazard resulting from materials analyzed. SGS Forensic Laboratories reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified. All samples were received in acceptable condition unless otherwise noted.



FORENSIC
LABORATORIES

Analysis Request Form (COC)

Client Name & Address: FACS Modesto 207 McHenry Avenue Modesto, CA 95354		Client No.: MOD08	PO / Job#: PJ62355	Date: 08-03-21
Contact: Daniel Prado		Phone: (775) 391-3524	Turn Around Time: Same Day / 1Day / 2Day / 3Day / 4Day / 5Day	
E-mail: dprado@forensicanalytical.com		<input type="checkbox"/> PCM: <input type="checkbox"/> NIOSH 7400A / <input type="checkbox"/> NIOSH 7400B <input type="checkbox"/> Rotometer <input checked="" type="checkbox"/> PLM: <input checked="" type="checkbox"/> Standard / <input type="checkbox"/> Point Count 400 - 1000 / <input type="checkbox"/> CARB 435		
Site Name: George Getto Transportation		<input type="checkbox"/> TEM Air: <input type="checkbox"/> AHERA / <input type="checkbox"/> Yamate2 / <input type="checkbox"/> NIOSH 7402 <input type="checkbox"/> TEM Bulk: <input type="checkbox"/> Quantitative / <input type="checkbox"/> Qualitative / <input type="checkbox"/> Chatfield <input type="checkbox"/> TEM Water: <input type="checkbox"/> Potable / <input type="checkbox"/> Non-Potable / <input type="checkbox"/> Weight % <input type="checkbox"/> TEM Dust: <input type="checkbox"/> D5755 (microvac) / <input type="checkbox"/> D6480 (wipe)		
Site Location: 1850 Kleppe Lane, Sparks, NV 89431		<input type="checkbox"/> IAQ Particle Identification (PLM LAB) <input type="checkbox"/> PLM Opaques/Soot <input type="checkbox"/> Particle Identification (TEM LAB) <input type="checkbox"/> Special Project <input type="checkbox"/> Metals Analysis Matrix: Method:		
Comments: Please email results to dprado@forensicanalytical.com			<input type="checkbox"/> Silica in Air <input type="checkbox"/> w/Gravimetry <input type="checkbox"/> Quartz Only	

Sample ID	Date / Time	Sample Location / Description	FOR AIR SAMPLES ONLY				Sample Area / Air Volume
			Type	Time On/Off	Avg LPM	Total Time	
PJ62355-01A	07-31-21	Single-Ply Roofing - White Roof A - West Side Center at Edge	A P C				
PJ62355-01B	07-31-21	Single-Ply Roofing - White Roof A - Center of Roof	A P C				
PJ62355-01C	07-31-21	Single-Ply Roofing - White Roof B - East Side Center at Edge	A P C				
PJ62355-02A	07-31-21	Penetration Mastic - White Roof A - NW Corner	A P C				
PJ62355-02B	07-31-21	Penetration Mastic - White Roof A - North Side West End	A P C				
PJ62355-02C	07-31-21	Penetration Mastic - White Roof A - East Side Center	A P C				
			A P C				
			A P C				
			A P C				
			A P C				

Sampled By: D. Prado		Date/Time: 07-31-21	Shipped Via: <input checked="" type="checkbox"/> Fed Ex <input type="checkbox"/> UPS <input type="checkbox"/> US Mail <input type="checkbox"/> Courier <input type="checkbox"/> Drop Off <input type="checkbox"/> Other:	
Relinquished By:	Relinquished By:		Relinquished By:	
Date / Time: 08-03-21	Date / Time:		Date / Time:	
Received By:	Received By:		Received By:	
Date / Time: AUG 04 REC'D	Date / Time:		Date / Time:	
Condition Acceptable? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Condition Acceptable? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Condition Acceptable? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	

SGS Forensic Laboratories may subcontract client samples to other SGSFL locations to meet client requests.

San Francisco Office: 3777 Depot Road, Suite 409, Hayward, CA 94545-2761 • Phone: 510/887-8828 • 800/827-3274

Los Angeles Office: 20535 South Belshaw Ave., Carson, CA 90746 • Phone: 310/763-2374 • 888/813-9417

Las Vegas Office: 6765 S. Eastern Avenue, Suite 3, Las Vegas, NV 89119 • Phone: 702/784-0040

Bulk Asbestos Analysis

(EPA Method 40CFR, Part 763, Appendix E to Subpart E and EPA 600/R-93-116, Visual Area Estimation)

NVLAP Lab Code: 101459-0

FACS - Modesto
Daniel Prado
21228 Cabot Blvd.

Hayward, CA 94545

Client ID: MOD08
Report Number: B321420
Date Received: 08/04/21
Date Analyzed: 08/09/21
Date Printed: 08/10/21
First Reported: 08/10/21

Job ID/Site: PJ62355; Washoe County School District - Capital Projects & Planning Getto
Transportation Center 1850 Kleppe Lane Sparks NV 89431

Date(s) Collected: 07/31/2021

SGSFL Job ID: MOD08
Total Samples Submitted: 6
Total Samples Analyzed: 6

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
PJ62355-01A	12457720						
Layer: White Drywall			ND				
Layer: Grey Non-Fibrous Material			ND				
Layer: White Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (20 %)	Fibrous Glass (10 %)						
PJ62355-01B	12457721						
Layer: White Drywall			ND				
Layer: Grey Non-Fibrous Material			ND				
Layer: White Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (20 %)	Fibrous Glass (10 %)						
PJ62355-01C	12457722						
Layer: White Drywall			ND				
Layer: Grey Non-Fibrous Material			ND				
Layer: White Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (20 %)	Fibrous Glass (10 %)						
PJ62355-02A	12457723						
Layer: White Non-Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
PJ62355-02B	12457724						
Layer: White Non-Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							
PJ62355-02C	12457725						
Layer: White Non-Fibrous Material			ND				
Total Composite Values of Fibrous Components:		Asbestos (ND)					
Cellulose (Trace)							

Client Name: FACS - Modesto

Report Number: B321420

Date Printed: 08/10/21

Sample ID	Lab Number	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer	Asbestos Type	Percent in Layer
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Tad Thrower, Laboratory Supervisor, Hayward Laboratory

Note: Limit of Quantification ('LOQ') = 1%. 'Trace' denotes the presence of asbestos below the LOQ. 'ND' = 'None Detected'.

Analytical results and reports are generated by SGS Forensic Laboratories (SGSFL) at the request of and for the exclusive use of the person or entity (client) named on such report. Results, reports or copies of same will not be released by SGSFL to any third party without prior written request from client. This report applies only to the sample(s) tested. Supporting laboratory documentation is available upon request. This report must not be reproduced except in full, unless approved by SGSFL. The client is solely responsible for the use and interpretation of test results and reports requested from SGSFL. SGSFL is not able to assess the degree of hazard resulting from materials analyzed. SGS Forensic Laboratories reserves the right to dispose of all samples after a period of thirty (30) days, according to all state and federal guidelines, unless otherwise specified. All samples were received in acceptable condition unless otherwise noted.

Appendix B

XRF Survey Data Tables, Lead Sample Chains-of-Custody, and Laboratory Results Reports

Lead Paint Chip Summary (Lab Report # M244498) WCSD – Getto Transportation Center – Pre-Demolition Survey Survey Date: August 10 & 11, 2022					
Sample Number	Component Location	Component	Color	Substrate	Analytical Results (mg/kg)
PJ71737-01-Pb-A	Building B – Space 32 – W center	Floor	Gray	Concrete	10
PJ71737-01-Pb-B	Building B – Space 32 – SE corner	Floor	Gray	Concrete	28
PJ71737-01-Pb-C	Building B – Space 32 – SE corner	Floor	Gray	Concrete	14
PJ71737-02-Pb-A	Space 201 – N center	Wall	White	Drywall	5
PJ71737-02-Pb-B	Space 201 – SE corner	Wall	White	Drywall	<3
PJ71737-02-Pb-C	Space 201 – E center	Wall	White	Drywall	<3
PJ71737-03-Pb-A	Space 200 – N Center wall	Wall	Light blue	Drywall	< 3
PJ71737-03-Pb-B	Space 200 – E wall – N end	Wall	Light blue	Drywall	< 3
PJ71737-03-Pb-C	Space 200 – E wall – N end	Wall	Light blue	Drywall	< 4
PJ71737-04-Pb-A	Building B – Space 32 – SW corner	Wall	Red	Concrete	24
PJ71737-04-Pb-B	Building B – Space 32 – W center	Wall	Red	Concrete	11
PJ71737-04-Pb-C	Building B – Space 32 – SW corner	Wall	Red	Concrete	48
PJ71737-05-Pb-A	Space 310 – W center	Doorframe	Dark gray	Wood	23
PJ71737-05-Pb-B	Space 309 – N center	Doorframe	Dark gray	Wood	68
PJ71737-05-Pb-C	Space 303 – NW corner	Doorframe	Dark Gray	Wood	82
PJ71737-06-Pb-A	300 building – ext – W center	Trim	Dark blue	Wood	33
PJ71737-06-Pb-B	300 building – ext – W center	Trim	Dark blue	Wood	55
PJ71737-06-Pb-C	300 building – ext – SW corner	Trim	Dark blue	Wood	120
PJ71737-07-Pb-A	Storage shed – ext – S side center	Wall	Mosaic	Wood	23

Lead Paint Chip Summary (Lab Report # M244498) WCSD – Getto Transportation Center – Pre-Demolition Survey Survey Date: August 10 & 11, 2022					
Sample Number	Component Location	Component	Color	Substrate	Analytical Results (mg/kg)
PJ71737-07-Pb-B	Storage shed – ext – S side center	Wall	Mosaic	Wood	7
PJ71737-07-Pb-C	Storage shed – ext – W side center	Wall	Mosaic	Wood	<3
PJ71737-08-Pb-A	Space 303 – S side, W end	Wall	Yellow	CMU	<3
PJ71737-08-Pb-B	Space 303 – S side, center	Wall	Yellow	CMU	<3
PJ71737-08-Pb-C	Space 303 – S side, E end	Wall	Yellow	CMU	320
PJ71737-09-Pb-A	Main building – ext – S side center	Curb	Red	Concrete	4
PJ71737-09-Pb-B	Main building – ext – S side, E end	Curb	Red	Concrete	<3
PJ71737-09-Pb-C	Main building – ext – S side, center	Curb	Red	Concrete	<3
PJ71737-10-Pb-A	Building 200 – ext – W side, center	Roof	Ligh blue	Metal	35
PJ71737-10-Pb-B	Building 200 – ext – W side, center	Roof	Light blue	Metal	26
PJ71737-10-Pb-C	Building 400 – ext – S side, W end	Roof	Light blue	Metal	<3
PJ71737-11-Pb-A	Building 300 – ext – E side, center	Wall	Blue gray	CMU	13
PJ71737-11-Pb-B	Building 300 – ext – S side, center	Wall	Blue gray	CMU	6
PJ71737-11-Pb-C	Building 300 – ext – W side, center	Wall	Blue gray	CMU	<3
PJ71737-12-Pb-A	Space 300 – N side, center	Wall	White	CMU	6
PJ71737-12-Pb-B	Space 306 – S side, center	Wall	White	CMU	6
PJ71737-12-Pb-C	Space 305 – S side, center	Wall	White	CMU	16
PJ71737-13-Pb-A	400 Building – ext – NW corner	Trim	Steel blue	Wood	40
PJ71737-13-Pb-B	400 building – ext – NW corner	Trim	Steel blue	Wood	89
PJ71737-13-Pb-C	400 building – ext – NW corner	Trim	Steel blue	Wood	110
PJ71737-14-Pb-A	Space 300 – S side, center	Floor	White	Concrete	38
PJ71737-14-Pb-B	Space 300 – N side, center	Floor	White	Concrete	19

Lead Paint Chip Summary (Lab Report # M244498) WCSD – Getto Transportation Center – Pre-Demolition Survey Survey Date: August 10 & 11, 2022					
Sample Number	Component Location	Component	Color	Substrate	Analytical Results (mg/kg)
PJ71737-14-Pb-C	Space 300 – center	Floor	White	Concrete	<3
PJ71737-15-Pb-A	Building 200 – ext – W side, center	Wall	White	Concrete	33
PJ71737-15-Pb-B	Building 200 – ext – NE corner	Wall	White	Concrete	38
PJ71737-15-Pb-C	Building 400 – W side, N end	Wall	White	Concrete	48
PJ71737-16-Pb-A	Space 26 – S side, E end	Floor	White	Concrete	<3
PJ71737-16-Pb-B	Space 26 – S side, W end	Floor	White	Concrete	15
PJ71737-16-Pb-C	Space 26 – S side, E end	Floor	White	Concrete	<3
PJ71737-17-Pb-A	Building 200 – N side, E end	Door	Medium blue	Metal	<3

Paint Chip Sample Request Form

Client: MOD08
FACS: Modesto, CA Office
Washoe County School District - Capital
Projects & Planning
Contact: Daniel Joseph Prado

Site: Getto
Transportation
Client #: C23305
Phone: 775-993-7389

Sampled By:
Zachary Ramos &
Danny Prado

Date: 8-10-22 & 8-11-22
PM: Daniel Joseph Prado
Proj #: PJ71737

Turnaround Time:	<12hr	Same-D	1-Day	2-Day	3-Day	5-Day	Other Due Date & Time:
Analysis:	ICP	Other					
Email results to:	dprado@forensicanalytical.com						

Sample #	Sample Location	Component	Color	Substrate	Condition
PJ71737-01-Pb-A	Building B – Space 32 – W center	Floor	Gray	Concrete	Fair
PJ71737-01-Pb-B	Building B – Space 32 – SE corner	Floor	Gray	Concrete	Fair
PJ71737-01-Pb-C	Building B – Space 32 – SE corner	Floor	Gray	Concrete	Fair
PJ71737-02-Pb-A	Space 201 – N center	Wall	White	Drywall	Intact
PJ71737-02-Pb-B	Space 201 – SE corner	Wall	White	Drywall	Intact
PJ71737-02-Pb-C	Space 201 – E center	Wall	White	Drywall	Intact
PJ71737-03-Pb-A	Space 200 – N Center wall	Wall	Light blue	Drywall	Intact

Substrate: wood, metal, concrete, plaster, drywall, brick

Shipped via:	FedEx	Airborne	UPS	US Mail	Courier	Drop Off	Other
Relinquished by: Zachary Ramos Date and Time: 8-12-22	Relinquished by: Date and Time:			Relinquished by: Date and Time:			
Received by: Date and Time: 8/15/22 9:28 AM F/C 1134	Received by: Date and Time:			Received by: Date and Time:			

Paint Chip Sample Request Form

Client: MOD08 Site: Getto Sampled By: Zachary Ramos & Daniel Prado
 FACS: Modesto, CA Office Date: 8-10-22 & 8-11-22
 Washoe County School District - Capital Client #: C23305 PM: Daniel Joseph Prado
 Projects & Planning Phone: 775-993-7389 Proj #: PJ71737
 Contact: Daniel Joseph Prado

Turnaround Time:	<12hr	Same-D	1-Day	2-Day	3-Day	<u>5-Day</u>	Other Due Date & Time:
Analysis:	<u>ICP</u>	Other					
Email results to:	dprado@forensicanalytical.com						

Sample #	Sample Location	Component	Color	Substrate	Condition
PJ71737-03-Pb-B	Space 200 – E wall – N end	Wall	Light blue	Drywall	Intact
PJ71737-03-Pb-C	Space 200 – E wall – N end	Wall	Light blue	Drywall	Intact
PJ71737-04-Pb-A	Building B – Space 32 – SW corner	Wall	Red	Concrete	Intact
PJ71737-04-Pb-B	Building B – Space 32 – W center	Wall	Red	Concrete	Intact
PJ71737-04-Pb-C	Building B – Space 32 – SW corner	Wall	Red	Concrete	Intact
PJ71737-05-Pb-A	Space 310 – W center	Doorframe	Dark gray	Wood	Intact
PJ71737-05-Pb-B	Space 309 – N center	Doorframe	Dark gray	Wood	Intact

Substrate: wood, metal, concrete, plaster, drywall, brick

Shipped via:	<u>FedEx</u>	Airborne	UPS	US Mail	Courier	Drop Off	Other
Relinquished by: <u>Zachary Ramos</u> Date and Time: <u>8-12-22</u>	Relinquished by: Date and Time:		Relinquished by: Date and Time:				
Received by: <u>[Signature]</u> Date and Time: <u>8/15/22 9:25 AM</u> <u>FIE 1134</u>	Received by: Date and Time:		Received by: Date and Time:				

Paint Chip Sample Request Form

Client: MOD08 Site: Getto
FACS: Modesto, CA Office
Washoe County School District - Capital Projects & Planning
Contact: Daniel Joseph Prado Client #: C23305
Phone: 775-993-7389

Sampled By: Zachary Ramos & Daniel Prado
Date: 8-10-22 & 8-11-22
PM: Daniel Joseph Prado
Proj #: PJ71737

Turnaround Time:	<12hr	Same-D	1-Day	2-Day	3-Day	<u>5-Day</u>	Other Due Date & Time:
Analysis:	<u>ICP</u>	Other					
Email results to:	dprado@forensicanalytical.com						

Sample #	Sample Location	Component	Color	Substrate	Condition
PJ71737-05-Pb-C	Space 303 – NW corner	Doorframe	Dark Gray	Wood	Intact
PJ71737-06-Pb-A	300 building – ext – W center	Trim	Dark blue	Wood	Intact
PJ71737-06-Pb-B	300 building – ext – W center	Trim	Dark blue	Wood	Intact
PJ71737-06-Pb-C	300 building – ext – SW corner	Trim	Dark blue	Wood	Intact
PJ71737-07-Pb-A	Storage shed – ext – S side center	Wall	Mosaic	Wood	Fair
PJ71737-07-Pb-B	Storage shed – ext – S side center	Wall	Mosaic	Wood	Fair
PJ71737-07-Pb-C	Storage shed – ext – W side center	Wall	Mosaic	Wood	Fair

Substrate: wood, metal, concrete, plaster, drywall, brick

Shipped via:	<u>FedEx</u>	Airborne	UPS	US Mail	Courier	Drop Off	Other
Relinquished by: Zachary Ramos Date and Time: 8-12-22	Relinquished by: Date and Time:			Relinquished by: Date and Time:			
Received by: [Signature] Date and Time: 8/15/22 9:25 AM	Received by: Date and Time:			Received by: Date and Time:			

7-16 1134

Paint Chip Sample Request Form

Client: MOD08 Site: Getto
FACS: Modesto, CA Office
Washoe County School District - Capital Projects & Planning
Contact: Daniel Joseph Prado Client #: C23305
Phone: 775-993-7389

Sampled By: Zachary Ramos & Daniel Prado
Date: 8-10-22 & 8-11-22
PM: Daniel Joseph Prado
Proj #: PJ71737

Turnaround Time:	<12hr	Same-D	1-Day	2-Day	3-Day	<u>5-Day</u>	Other Due Date & Time:
Analysis:	<u>ICP</u>	Other					
Email results to:	dprado@forensicanalytical.com						

Sample #	Sample Location	Component	Color	Substrate	Condition
PJ71737-08-Pb-A	Space 303 – S side, W end	Wall	Yellow	CMU	Intact
PJ71737-08-Pb-B	Space 303 – S side, center	Wall	Yellow	CMU	Intact
PJ71737-08-Pb-C	Space 303 – S side, E end	Wall	Yellow	CMU	Intact
PJ71737-09-Pb-A	Main building – ext – S side center	Curb	Red	Concrete	Fair
PJ71737-09-Pb-B	Main building – ext – S side, E end	Curb	Red	Concrete	Fair
PJ71737-09-Pb-C	Main building – ext – S side, center	Curb	Red	Concrete	Fair
PJ71737-10-Pb-A	Building 200 – ext – W side, center	Roof	Ligh blue	Metal	Intact

Substrate: wood, metal, concrete, plaster, drywall, brick

Shipped via:	<u>FedEx</u>	Airborne	UPS	US Mail	Courier	Drop Off	Other
Relinquished by: Zachary Ramos Date and Time: 8-12-22	Relinquished by: Date and Time:			Relinquished by: Date and Time:			
Received by: [Signature] Date and Time: 8/15/22 9:25 AM FIC 1134	Received by: Date and Time:			Received by: Date and Time:			

Paint Chip Sample Request Form

Client: MOD08

FACS: Modesto, CA Office

Washoe County School District - Capital
Projects & Planning
Contact: Daniel Joseph Prado

Site: Getto
Transportation

Client #: C23305

Phone: 775-993-7389

Sampled By:
Zachary Ramos &
Danny Prado

Date: 8-10-22 & 8-11-22

PM: Daniel Joseph Prado

Proj #: PJ71737

Turnaround Time:	<12hr	Same-D	1-Day	2-Day	3-Day	<u>5-Day</u>	Other Due Date & Time:
Analysis:	ICP Other						
Email results to:	dprado@forensicanalytical.com						

Sample #	Sample Location	Component	Color	Substrate	Condition
PJ71737-10-Pb-B	Building 200 – ext – W side, center	Roof	Light blue	Metal	Intact
PJ71737-10-Pb-C	Building 400 – ext – S side, W end	Roof	Light blue	Metal	Intact
PJ71737-11-Pb-A	Building 300 – ext – E side, center	Wall	Blue gray	CMU	Intact
PJ71737-11-Pb-B	Building 300 – ext – S side, center	Wall	Blue gray	CMU	Intact
PJ71737-11-Pb-C	Building 300 – ext – W side, center	Wall	Blue gray	CMU	Intact
PJ71737-12-Pb-A	Space 300 – N side, center	Wall	White	CMU	Intact
PJ71737-12-Pb-B	Space 306 – S side, center	Wall	White	CMU	Intact

Substrate: wood, metal, concrete, plaster, drywall, brick

Shipped via:	<u>FedEx</u>	Airborne	UPS	US Mail	Courier	Drop Off	Other
Relinquished by: Zachary Ramos	Relinquished by:	Relinquished by:					
Date and Time: 8-12-22	Date and Time:	Date and Time:					
Received by: [Signature]	Received by:	Received by:					
Date and Time: 8/15/22 9:25 AM	Date and Time:	Date and Time:					

FILE 1134

Paint Chip Sample Request Form

Client: MOD08 Site: Getto
FACS: Modesto, CA Office
Washoe County School District - Capital Projects & Planning
Contact: Daniel Joseph Prado Client #: C23305
Phone: 775-993-7389

Sampled By: Zachary Ramos & Daniel Prado
Date: 8-10-22 & 8-11-22
PM: Daniel Joseph Prado
Proj #: PJ71737

Turnaround Time:	<12hr	Same-D	1-Day	2-Day	3-Day	<u>5-Day</u>	Other Due Date & Time:
Analysis:	<u>ICP</u>	Other					
Email results to:	dprado@forensicanalytical.com						

Sample #	Sample Location	Component	Color	Substrate	Condition
PJ71737-12-Pb-C	Space 305 – S side, center	Wall	White	CMU	Intact
PJ71737-13-Pb-A	400 Building – ext – NW corner	Trim	Steel blue	Wood	Intact
PJ71737-13-Pb-B	400 building – ext – NW corner	Trim	Steel blue	Wood	Intact
PJ71737-13-Pb-C	400 building – ext – NW corner	Trim	Steel blue	Wood	Intact
PJ71737-14-Pb-A	Space 300 – S side, center	Floor	White	Concrete	Intact
PJ71737-14-Pb-B	Space 300 – N side, center	Floor	White	Concrete	Intact
PJ71737-14-Pb-C	Space 300 – center	Floor	White	Concrete	Intact

Substrate: wood, metal, concrete, plaster, drywall, brick

Shipped via:	<u>FedEx</u>	Airborne	UPS	US Mail	Courier	Drop Off	Other
Relinquished by: Zachary Ramos Date and Time: 8-12-22	Relinquished by: Date and Time:			Relinquished by: Date and Time:			
Received by: [Signature] Date and Time: 8/18/22 9:25 AM	Received by: Date and Time:			Received by: Date and Time:			

FILE 1134

Paint Chip Sample Request Form

Client: MOD08 Site: Getto
 FACS: Modesto, CA Office
 Washoe County School District - Capital Projects & Planning
 Contact: Daniel Joseph Prado Client #: C23305
 Phone: 775-993-7389

Sampled By: Zachary Ramos & Daniel Prado
 Date: 8-10-22 8-11-22
 PM: Daniel Joseph Prado
 Proj #: PJ71737

Turnaround Time:	<12hr	Same-D	1-Day	2-Day	3-Day	<u>5-Day</u>	Other Due Date & Time:
Analysis:	<u>ICP</u>	Other					
Email results to:	dprado@forensicanalytical.com						

Sample #	Sample Location	Component	Color	Substrate	Condition
PJ71737-15-Pb-A	Building 200 – ext – W side, center	Wall	White	Concrete	Intact
PJ71737-15-Pb-B	Building 200 – ext – NE corner	Wall	White	Concrete	Intact
PJ71737-15-Pb-C	Building 400 – W side, N end	Wall	White	Concrete	Intact
PJ71737-16-Pb-A	Space 26 – S side, E end	Floor	White	Concrete	Intact
PJ71737-16-Pb-B	Space 26 – S side, W end	Floor	White	Concrete	Intact
PJ71737-16-Pb-C	Space 26 – S side, E end	Floor	White	Concrete	Intact
PJ71737-17-Pb-A	Building 200 – N side, E end	Door	Medium blue	Metal	Intact

Substrate: wood, metal, concrete, plaster, drywall, brick

Shipped via:	<u>FedEx</u>	Airborne	UPS	US Mail	Courier	Drop Off	Other
Relinquished by: <u>Zachary Ramos</u> Date and Time: <u>8-12-22</u>	Relinquished by: Date and Time:			Relinquished by: Date and Time:			
Received by: <u>[Signature]</u> Date and Time: <u>8/15/22 9:25AM</u> <u>F/E 1139</u>	Received by: Date and Time:			Received by: Date and Time:			

Metals Analysis of Bulks - TTLC

(AIHA-LAP, LLC Accreditation, Lab ID #101629)

FACS - Modesto

Daniel Prado

21228 Cabot Blvd.

Hayward, CA 94545

Client ID: MOD08

Report Number: M244498

Date Received: 08/15/22

Date Analyzed: 08/22/22

Date Printed: 08/22/22

First Reported: 08/22/22

Job ID / Site: PJ71737; Washoe County School District - Capital Projects & Planning Getto
Transportation 1850 Kleppe Lane Sparks NV

SGSFL Job ID: MOD08

Date(s) Collected: 8/10/22, 8/11/22

Total Samples Submitted: 49

Total Samples Analyzed: 49

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit*	Method Reference
PJ71737-01-PB-A	LM227304	Pb	10	mg/kg	3	EPA 3050B/6010B
PJ71737-01-PB-B	LM227305	Pb	28	mg/kg	3	EPA 3050B/6010B
PJ71737-01-PB-C	LM227306	Pb	14	mg/kg	3	EPA 3050B/6010B
PJ71737-02-PB-A	LM227307	Pb	5	mg/kg	3	EPA 3050B/6010B
PJ71737-02-PB-B	LM227308	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-02-PB-C	LM227309	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-03-PB-A	LM227310	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-03-PB-B	LM227311	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-03-PB-C	LM227312	Pb	< 4	mg/kg	4	EPA 3050B/6010B
PJ71737-04-PB-A	LM227313	Pb	24	mg/kg	3	EPA 3050B/6010B
PJ71737-04-PB-B	LM227314	Pb	11	mg/kg	3	EPA 3050B/6010B
PJ71737-04-PB-C	LM227315	Pb	48	mg/kg	3	EPA 3050B/6010B
PJ71737-05-PB-A	LM227316	Pb	23	mg/kg	3	EPA 3050B/6010B
PJ71737-05-PB-B	LM227317	Pb	68	mg/kg	5	EPA 3050B/6010B
PJ71737-05-PB-C	LM227318	Pb	82	mg/kg	3	EPA 3050B/6010B
PJ71737-06-PB-A	LM227319	Pb	33	mg/kg	3	EPA 3050B/6010B
PJ71737-06-PB-B	LM227320	Pb	55	mg/kg	3	EPA 3050B/6010B
PJ71737-06-PB-C	LM227321	Pb	120	mg/kg	3	EPA 3050B/6010B
PJ71737-07-PB-A	LM227322	Pb	23	mg/kg	3	EPA 3050B/6010B
PJ71737-07-PB-B	LM227323	Pb	7	mg/kg	3	EPA 3050B/6010B
PJ71737-07-PB-C	LM227324	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-08-PB-A	LM227325	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-08-PB-B	LM227326	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-08-PB-C	LM227327	Pb	320	mg/kg	6	EPA 3050B/6010B
Comment: Sample submission below recommended weight.						
PJ71737-09-PB-A	LM227328	Pb	4	mg/kg	3	EPA 3050B/6010B
PJ71737-09-PB-B	LM227329	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-09-PB-C	LM227330	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-10-PB-A	LM227331	Pb	35	mg/kg	3	EPA 3050B/6010B
PJ71737-10-PB-B	LM227332	Pb	26	mg/kg	3	EPA 3050B/6010B



Metals Analysis of Bulks - TTLC

(AIHA-LAP, LLC Accreditation, Lab ID #101629)

FACS - Modesto

Daniel Prado

21228 Cabot Blvd.

Hayward, CA 94545

Client ID: MOD08

Report Number: M244498

Date Received: 08/15/22

Date Analyzed: 08/22/22

Date Printed: 08/22/22

First Reported: 08/22/22

Job ID / Site: PJ71737; Washoe County School District - Capital Projects & Planning Getto
Transportation 1850 Kleppe Lane Sparks NV

SGSFL Job ID: MOD08

Date(s) Collected: 8/10/22, 8/11/22

Total Samples Submitted: 49

Total Samples Analyzed: 49

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit*	Method Reference
PJ71737-10-PB-C	LM227333	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-11-PB-A	LM227334	Pb	13	mg/kg	3	EPA 3050B/6010B
PJ71737-11-PB-B	LM227335	Pb	6	mg/kg	3	EPA 3050B/6010B
PJ71737-11-PB-C	LM227336	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-12-PB-A	LM227337	Pb	6	mg/kg	3	EPA 3050B/6010B
PJ71737-12-PB-B	LM227338	Pb	6	mg/kg	3	EPA 3050B/6010B
PJ71737-12-PB-C	LM227339	Pb	16	mg/kg	3	EPA 3050B/6010B
PJ71737-13-PB-A	LM227340	Pb	40	mg/kg	4	EPA 3050B/6010B
PJ71737-13-PB-B	LM227341	Pb	89	mg/kg	3	EPA 3050B/6010B
PJ71737-13-PB-C	LM227342	Pb	110	mg/kg	3	EPA 3050B/6010B
PJ71737-14-PB-A	LM227343	Pb	38	mg/kg	3	EPA 3050B/6010B
PJ71737-14-PB-B	LM227344	Pb	19	mg/kg	3	EPA 3050B/6010B
PJ71737-14-PB-C	LM227345	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-15-PB-A	LM227346	Pb	33	mg/kg	3	EPA 3050B/6010B
PJ71737-15-PB-B	LM227347	Pb	38	mg/kg	3	EPA 3050B/6010B
PJ71737-15-PB-C	LM227348	Pb	48	mg/kg	5	EPA 3050B/6010B
PJ71737-16-PB-A	LM227349	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-16-PB-B	LM227350	Pb	15	mg/kg	4	EPA 3050B/6010B
PJ71737-16-PB-C	LM227351	Pb	< 3	mg/kg	3	EPA 3050B/6010B
PJ71737-17-PB-A	LM227352	Pb	< 3	mg/kg	3	EPA 3050B/6010B

Metals Analysis of Bulks - TTLC

(AIHA-LAP, LLC Accreditation, Lab ID #101629)

FACS - Modesto
Daniel Prado
21228 Cabot Blvd.

Hayward, CA 94545

Client ID: MOD08
Report Number: M244498
Date Received: 08/15/22
Date Analyzed: 08/22/22
Date Printed: 08/22/22
First Reported: 08/22/22

Job ID / Site: PJ71737; Washoe County School District - Capital Projects & Planning Getto
Transportation 1850 Kleppe Lane Sparks NV

Date(s) Collected: 8/10/22, 8/11/22

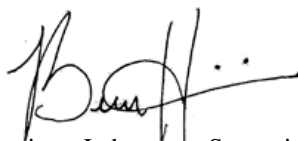
SGSFL Job ID: MOD08

Total Samples Submitted: 49

Total Samples Analyzed: 49

Sample Number	Lab Number	Analyte	Result	Result Units	Reporting Limit*	Method Reference
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* The Reporting Limit represents the lowest amount of analyte that the laboratory can confidently detect in the sample, and is not a regulatory level. The Units for the Reporting Limit are the same as the Units for the Final Results.



Beatriz Hinojosa, Laboratory Supervisor, Carson Laboratory

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Note* Sampling data used in this report was provided by the client as noted on the associated chain of custody form.

Date: 04-21-21

Contact Name: Daniel Prado

Bill:

Collected by: Daniel Prado

Date Collected: 04-21-21

Type of Analysis: ICP

Turnaround Time: ~~2 days~~ 3 DAY

Laboratory: Schneider Laboratories Global Inc

Job ID: PJ62355

Job Site: Gettys Transportation - 1850 Kleppe Lane Sparks, NV 89431

Special

Instructions: Please email results to dprado@forensicanalytical.com

Send Results:

S 3

415054

V:\415\415054

fghraizi

4/22/2021 9:32:39 AM

Federal Express

786270489881

Submitted By:

Date:

Received By:

Date:

04-21-21



Analysis Report

Schneider Laboratories Global, Inc

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • Fax 804-359-1475

Customer: Forensic Analytical Consulting Services (5182)
Address: 21228 Cabot Blvd
Hayward, CA 94545

Order #: 415054

Matrix Paint
Received 04/22/21
Reported 04/27/21

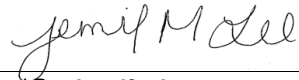
Attn:

Project: Getto Transportation
Location: 1850 Kleppe Lane, Sparks, NV
Number: PJ62355

PO Number: PO 0234

Sample ID	Cust. Sample ID	Location	Result	RL*	Units	Analysis Date	Analyst
Parameter		Method					
415054-001	PJ62355-101PbA	White Paint/Coating					
Metals Analysis							
Lead		EPA 6010D	14.9	9.48	mg/kg	04/27/21	DLJ
415054-002	PJ62355-101PbB	White Paint/Coating					
Metals Analysis							
Lead		EPA 6010D	7.17	6.39	mg/kg	04/27/21	DLJ
415054-003	PJ62355-101PbC	White Paint/Coating					
Metals Analysis							
Lead		EPA 6010D	8.78	6.51	mg/kg	04/27/21	DLJ

415054-04/27/21 05:47 PM


Reviewed By: **Jennifer Lee**
Manager

State Certifications

Method	Parameter	Nevada	Virginia
EPA 6010D	Lead	Not Certified	VELAP Certified

State	Certificate Number
Virginia	VELAP 11259

All internal QC parameters were met. Unusual sample conditions, if any, are described. Surrogate Spike results designated with "D" indicate that the analyte was diluted out. "MI" indicates matrix interference. Concentration and *Reporting Limit (RL) based on areas provided by client. Values are reported to three significant figures. Solid PPM = mg/kg | PPB = µg/kg and Water PPM = mg/L | PPB = µg/L. The test results reported relate only to the samples submitted.

SURVEY FOR LEAD BASED PAINT
Wcsd

Site Name:	Getto Transportation							Date:	8/10/22 & 8/11/22	
Address:	1850 Kleppe Ln. Sparks, NV 89431							FACS Job #:	PJ71737	
Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
1.	200 Building South Side Exterior	Light Blue	Wood	Siding	I	0.01
2.	200 Building South Side Exterior	Light Blue	Wood	Garage Frame	I	0.00
3.	200 Building South Side Exterior	Light Blue	Wood	Garage Frame	I	0.00
4.	200 Building South Side Exterior	Light Blue	Wood	Garage Frame	I	0.00
5.	200 Building East Side Exterior	White	Concrete	Wall	I	0.00
6.	200 Building West Side Exterior	White	Concrete	Wall	I	0.00
7.	200 Building Northwest Side Exterior	White	Concrete	Wall	I	0.00
8.	200 Building West Side Exterior	Light Blue	Metal	Roofing	I	0.00
9.	200 Building West Side Exterior	Light Blue	Metal	Roofing	I	0.00
10.	200 Building East Side Exterior	Light Blue	Metal	Roofing	I	0.00
11.	200 Building North Side Exterior	Medium Blue	Metal	Door	I	0.00
12.	200 Building North Side Exterior	Medium Blue	Metal	Frame	I	0.00
13.	200 Building North Side Exterior	Medium Blue	Metal	Frame	I	0.00
14.	200 Building North Side Exterior	Light Blue	Metal	Electrical Unit	I	0.03
15.	200 Building North Side Exterior	Light Blue	Wood	Siding	I	0.7
16.	200 Building North Side Exterior	Grey Blue	Wood	Door Frame	I	0.00
17.	200 Building South Side Exterior	White	Metal	Garage	I	0.00
18.	Calibration: 1.04=0.9/ 1.04= 0.9/1.04=0.9	-	-	-	-	-
19.	200 Building Space 200 West Side	Seafoam Green	Metal	Shelving	I	0.12

SURVEY FOR LEAD BASED PAINT
Wcsd

Site Name:	Getto Transportation							Date:	8/10/22 & 8/11/22	
Address:	1850 Kleppe Ln. Sparks, NV 89431							FACS Job #:	PJ71737	
Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
20.	200 Building Space 200 Southeast Side	Clear	Wood	Wall Panel	I	0.00
21.	200 Building Space 200 South Center	Grey	Wood	Door	I	0.04
22.	200 Building Space 200 South Center	Tan	Wood	Door	I	0.15
23.	200 Building Space 200 North Center	Light Blue	Drywall	Wall	I	0.00
24.	200 Building Space 200 North Center	Light Blue	Drywall	Wall	I	0.00
25.	200 Building Space 200 North Center	Light Blue	Drywall	Wall	I	0.00
26.	200 Building Space 200 Northeast Corner	White	Wood	Ceiling	I	0.00
27.	200 Building Space 200 East Center	White	Wood	Ceiling	I	0.25
28.	200 Building Space 200 West Center	White	Wood	Ceiling	I	0.4
29.	200 Building Space 200 South Center	Clear	Wood	Wall Panel	I	0.00
30.	Calibration: 1.04=1.0/ 1.04= 1.1/1.04=0.9	-	-	-	-	-
31.	300 Building South Center Exterior	Blue Grey	CMU	Wall	I	0.00
32.	300 Building South Center Exterior	Blue Grey	CMU	Wall	I	0.00
33.	300 Building East Center Exterior	Blue Grey	CMU	Wall	I	0.00
34.	300 Building South Center Exterior	Blue Grey	Metal	Electric Pipe	I	0.03
35.	300 Building West Center Exterior	Blue	Wood	Trim	I	0.00
36.	300 Building West Center Exterior	Blue	Wood	Trim	I	0.00
37.	300 Building South Center Exterior	Blue Grey	Wood	Panel	I	1.0
38.	300 Building South Center Exterior	Blue Grey	Metal	Door Frame	I	0.15
39.	300 Building South Center Exterior	Grey	Metal	Door	I	0.00

SURVEY FOR LEAD BASED PAINT
Wcsd

Site Name:	Getto Transportation							Date:	8/10/22 & 8/11/22	
Address:	1850 Kleppe Ln. Sparks, NV 89431							FACS Job #:	PJ71737	
Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
40.	300 Building South Center Exterior	Grey	Metal	Door	I	0.00
41.	Space 303 South	Yellow	CMU	Wall	I	0.00
42.	Space 303 South	Yellow	CMU	Wall	I	0.00
43.	Space 303 South	Yellow	CMU	Wall	I	0.00
44.	Space 303 South	Eggshell	Metal	Elec. Box	I	0.00
45.	Space 303 South	Eggshell	Metal	Elec. Box	I	0.00
46.	Space 303 South	Eggshell	Metal	Elec. Box	I	0.00
47.	Space 303 West Center	White	Drywall	Wall	I	0.00
48.	Space 303 East Center	White	Drywall	Wall	I	0.00
49.	Space 303 North Center	White	Drywall	Wall	I	0.00
50.	Space 303 West Center	Light Grey	Wood	Door Frame	I	0.01
51.	Space 303 West Center	Light Grey	Wood	Door Frame	I	0.00
52.	Space 303 West Center	Light Grey	Wood	Door Frame	I	0.00
53.	Space 303 East Center	Light Grey	Wood	Door Frame	I	0.04
54.	Space 303 West	Dark Grey	Wood	Door Frame	I	0.00
55.	Space 303 West	Dark Grey	Wood	Door Frame	I	0.00
56.	Space 303 West	Dark Grey	Wood	Door Frame	I	0.00
57.	Space 303 South Center	Cobalt	Metal	Cabinet	I	0.00
58.	Calibration: 1.04=1.1/ 1.04= 0.9/1.04=1.0	-	-	-	-	-
59.	Space 308 Southeast Corner	Yellow	Drywall	Wall	I	0.04

SURVEY FOR LEAD BASED PAINT
Wcsd

Site Name:	Getto Transportation							Date:	8/10/22 & 8/11/22	
Address:	1850 Kleppe Ln. Sparks, NV 89431							FACS Job #:	PJ71737	
Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
60.	Space 308 North Center	Yellow	Drywall	Wall	I	0.04
61.	Space 308 South Center	Clear	Wood	Panel	I	0.00
62.	Space 303 Restroom Hallway North Center	Light Grey	Drywall	Wall	I	0.01
63.	Space 303 Restroom Hallway South Center	Light Grey	Drywall	Wall	I	0.00
64.	Space 305 West Center	White	Drywall	Wall	I	0.04
65.	Space 305 South Center	White	CMU	Wall	I	0.00
66.	Space 305 Southeast Corner	White	Porcelain	Toilet	I	0.00
67.	Space 306 South Center	White	CMU	Wall	I	0.00
68.	Space 306 East Center	White	Drywall	Wall	I	0.01
69.	Space 306 Southwest Corner	White	Porcelain	Toilet	I	0.01
70.	Space 309 North Center	Dark Grey	Wood	Door Frame	I	0.00
71.	Space 309 North Center	Dark Grey	Wood	Door Frame	I	0.00
72.	Space 300 North Center	White	Concrete	Floor	I	0.00
73.	Space 300 North Center	White	CMU	Wall	I	0.00
74.	Space 300 Northeast Corner	White	Concrete	Floor	I	0.00
75.	Space 300 South Center	White	Drywall	Wall	I	0.00
76.	Space 400 Northwest Corner	Tan	Drywall	Wall	I	0.00
77.	Space 400 East Center	White	Wood	Wall Frame	I	0.00
78.	Space 400 East Center	Tan	Drywall	Wall	I	0.00
79.	Space 400 West-Northwest Center	White	Wood	Door	I	0.00

SURVEY FOR LEAD BASED PAINT
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Site Name:	Getto Transportation							Date:	8/10/22 & 8/11/22	
Address:	1850 Kleppe Ln. Sparks, NV 89431							FACS Job #:	PJ71737	
Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	
No.	Sample Location				Color	Substrate	Component	Condition	XRF Result (mg/cm2)	
80.	Space 400 North Center				White	Metal	Heater	I	0.00	
81.	Space 400 Northeast Corner				White	Wood	Door	I	0.00	
82.	Space 402 Southeast Corner				Tan	Drywall	Wall	I	0.00	
83.	Space 402 East Center				White	Wood	Door	I	0.00	
84.	Space 402 West Center				White	Wood	Window Frame	I	0.00	
85.	Space 402 Northeast Corner				White	Wood	Baseboard	I	0.01	
86.	Space 402 Northeast Corner				Tan	Metal	Conduit	I	0.01	
87.	Space 403 North Center				White	Wood	Baseboard	I	0.00	
88.	Space 403 West Center				Tan	Drywall	Wall	I	0.00	
89.	Space 403 Southwest Center				Clear	Laminate	Floor	I	0.00	
90.	Space 403 Center of Space				White	Drywall	Ceiling	I	0.00	
91.	Space 404 North Center				Tan	Drywall	Wall	I	0.01	
92.	Space 404 West Center				Tan	Drywall	Wall	I	0.02	
93.	Space 404 East Center				White	Wood	Wall Frame	I	0.00	
94.	Space 404 West Center				White	Wood	Baseboard	I	0.00	
95.	Space 404 West Center				White	Wood	Door Frame	I	0.00	
96.	Space 403 North Center				White	Wood	Wall Frame	I	0.00	
97.	Space 405 North Center				Tan	Drywall	Wall	I	0.00	
98.	Space 405 North Center				Tan	Wood	Shelf	I	0.00	
99.	Space 405 Southwest Corner				White	Drywall	Ceiling	I	0.02	

SURVEY FOR LEAD BASED PAINT
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Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
100	Space 405 Southwest Corner	White	Wood	Frame	I	0.04
101	Space 405 South Center	White	Wood	Wood Frame	I	0.04
102	Space 405 South Center	White	Wood	Baseboard	I	0.09
103	Space 406 South Center	White	Wood	Door	I	0.01
104	Space 406 South Center	White	Drywall	Ceiling	I	0.15
105	Space 406 West Center	Tan	Drywall	Wall	I	0.00
106	Space 406 Northwest Corner	Tan	Plastic	Wall	I	0.00
107	Space 407 North Center	White	Drywall	Wall	I	0.03
108	Space 407 South Center	Tan	Drywall	Wall	I	0.03
109	Space 407 North Center	White	Wood	Wall Frame	I	0.03
110	Space 407 Northwest Corner	White	Wood	Baseboard	I	0.13
111	Space 408 Southwest Corner	White	Wood	Wall	I	0.03
112	Space 408 Center	Tan	Metal	Heater	I	0.00
113	Space 409 East Center	Tan	Wood	Vanity	I	0.00
114	Space 409 Northwest Corner	White	Porcelain	Toilet	I	0.01
115	Space 409 East Center	White	Wood	Wall	I	0.08
116	Space 410 Entrance to 411	White	Wood	Stall Door	I	0.05
117	Space 410 North Center	White	Porcelain	Toilet	I	0.01
118	Space 410 South Center	Tan	Wood	Frame	I	0.03
119	Space 411 West Center	Tan	Wood	Wall Frame	I	0.07

SURVEY FOR LEAD BASED PAINT
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Site Name:	Getto Transportation							Date:	8/10/22 & 8/11/22	
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Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
120	Space 412 East Center	White	Wood	Shelf	I	0.00
121	Space 412 West Center	White	Wood	Wall	I	0.01
122	Space 413 North Center	White	Wood	Baseboard	I	0.01
123	Space 413 East Center	White	Metal	Cabinet	I	0.00
124	Space 413 East Center	White	Wood	Cabinet	I	0.01
125	Space 413 East Center	Tan	Wood	Wall Frame	I	0.00
126	400 Building South Center Exterior	Light Blue	Metal	Roof	I	0.00
127	400 Building South Center Exterior	White	Concrete	Foundation	I	0.00
128	400 Building South Center Exterior	White	CMU	Wall	I	0.00
129	400 Building South Center Exterior	Yellow	Metal	Pole	I	2.5
130	400 Building South Center Exterior	Yellow	Concrete	Steps	I	0.01
131	400 Building South Center Exterior	Steel Blue	Wood	Door Frame	I	0.00
132	400 Building South Center Exterior	Steel Blue	Wood	Door Frame	I	0.00
133	400 Building South Center Exterior	Light Blue	Wood	Siding	I	0.00
134	400 Building East Center Exterior	Steel Blue	Wood	Frame	I	0.00
135	300 Building North Center Exterior	Off-White	Metal	Conex Box	I	0.01
136	300 Building North Center Exterior	Pale Yellow	Metal	Conex Box	I	0.01
137	300 Building North Center Exterior	Pale Yellow	Metal	Conex Box	I	0.04
138	300 Building North Center Exterior	Pale Yellow	Metal	Conex Box	I	0.04
139	400 Building North Parking Lot	Yellow	Concrete	Curb	I	0.06

SURVEY FOR LEAD BASED PAINT
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Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
140	400 Building North Parking Lot	White	Asphalt	Floor	I	0.00
141	Day start Calibration: 1.04=1.0/ 1.04= 0.9/1.04=1.1	-	-	-	-	-
142	Building B West Center Exterior	Tan	Concrete	Wall	I	0.04
143	Building B West Center Exterior	Tan	Metal	Elec. Box	I	0.00
144	Building B Southwest Corner Exterior	Dark Brown	Metal	Gutter	I	0.00
145	Building B South Center Exterior	Tan	Concrete	Wall	I	0.00
146	Building B South Center Exterior	Dark Brown	Metal	Door	I	0.00
147	Building B Southwest Corner Exterior	Dark Brown	Metal	Door	I	0.01
148	Building B South Center Exterior	Tan	Metal	Elec. Box	I	0.00
149	Building B East Center Exterior	Tan	Concrete	Wall	I	0.09
150	Building B Northeast Corner Exterior	Dark Brown	Metal	Gutter	I	0.00
151	Building B North Center Exterior	Tan	Concrete	Wall	I	0.00
152	Building B Space 34 East Center Interior	Red	Metal	I-Beam	I	0.00
153	Building B Space 34 West Center	Red	Metal	I-Beam	I	0.00
154	Building B Space 34 Southwest Corner	Red	Metal	I-Beam	I	0.02
155	Building B Space 33 South Center	White	Concrete	Wall	I	0.00
156	Building B Space 33 East Center	White	Concrete	Wall	I	0.00
157	Building B Space 33 West Center	White	Concrete	Wall	I	0.00
158	Building B West Center Exterior	Lime Green	Metal	Door	I	0.04
159	Building B Space 32 West Center Interior	Red	Concrete	Wall	I	0.00

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Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
160	Building B Space 32 North Center	Red	Concrete	Wall	I	0.00
161	Building B Space 32 East Center	White	Concrete	Wall	I	0.00
162	Building B Space 32 Center	Grey	Concrete	Floor	I	0.00
163	Building B Space 32 Southwest Corner	Grey	Concrete	Floor	I	0.00
164	Calibration: 1.04=0.9/ 1.04= 1.0/1.04=1.1	-	-	-	-	-
165	Parking Lot South	Pale Yellow	Metal	Conex Box	F	0.2
166	Parking Lot South	Yellow	Concrete	Floor	I	0.00
167	Parking Lot West Gas Storage	Yellow	Concrete	Pillar	I	0.00
168	Parking Lot West Gas Storage	Yellow	Concrete	Pillar	I	0.00
169	Parking Lot West Gas Storage	Yellow	Concrete	Pillar	I	0.00
170	Parking Lot West Gas Storage	Tan	Metal	Stairs	I	0.00
171	Parking Lot West Gas Storage	Sea Foam	Metal	Foundation	I	0.00
172	Parking Lot West Gas Storage	Sea Foam	Metal	Foundation	I	0.00
173	Parking Lot West Gas Storage	White	Metal	Tank	I	0.00
174	Parking Lot West Gas Storage	White	Metal	Tank	I	0.05
175	Parking Lot West Gas Storage	White	Metal	Tank	I	0.00
176	Parking Lot West Gas Storage	Yellow	Metal	Pipe	I	0.00
177	Parking Lot West Gas Storage	Pale Yellow	Metal	Pipe Cover	I	0.00
178	Parking Lot West Gas Storage	Sea Foam	Metal	Foundation	I	0.00
179	Parking Lot West Gas Storage	Grey	Metal	Tank	I	0.00

SURVEY FOR LEAD BASED PAINT
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Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
180	Parking Lot West Central Gas Storage	Grey	Metal	Tank	I	0.07
181	Parking Lot South Gas Station	Yellow	Metal	Light Post	I	0.01
182	Parking Lot South Gas Station	Yellow	Concrete	Pillar	I	0.06
183	Parking Lot South Gas Station	Red	Metal	Curb	I	0.00
184	Parking Lot South Gas Station	Red	Metal	Curb	I	0.01
185	Parking Lot South Gas Station	Black	Metal	Meter	I	0.00
186	Parking Lot South Gas Station	Yellow	Concrete	Lamp Post Base	I	0.03
187	Parking Lot South Gas Station	White	Metal	Natural Gas Pump	I	0.01
188	Parking Lot South Gas Station	Red	Metal	Fire Hydrant	I	0.00
189	Parking Lot South Gas Station	Red	Metal	Fire Hydrant	I	0.00
190	Parking Lot Center	White	Wood	Storage Shed	I	0.00
191	Parking Lot Center	White	Wood	Storage Shed	I	0.00
192	Parking Lot Center	Grey	Wood	Storage Shed	I	0.00
193	Parking Lot North	White	Concrete	Jersey Barrier	I	0.00
194	Parking Lot North	White	Concrete	Jersey Barrier	I	0.00
195	Parking Lot North	White	Concrete	Jersey Barrier	I	0.00
196	Parking Lot North	White	Metal	Natural Gas Pump	I	0.00
197	Parking Lot North	White	Metal	Gas Tank	I	0.00
198	Parking Lot North	White	Metal	Gas Tank	I	0.02
199	Parking Lot North	Yellow	Concrete	Curb Line	I	0.00

SURVEY FOR LEAD BASED PAINT
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Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
200	Parking Lot Northwest	Pale Yellow	Metal	Conex Box	I	0.02
201	Parking Lot West	Light Grey	Metal	Conex Box	I	0.00
202	Parking Lot West	Light Grey	Metal	Conex Box	I	0.00
203	Parking Lot West	Pale Yellow	Metal	Conex Box	I	0.00
204	Building A North Center Exterior	Dark Brown	Metal	Garage Door	I	0.05
205	Building A North Center Exterior	Dark Brown	Metal	Garage Door	I	0.00
206	Building A North Center Exterior	Tan	Concrete	Wall	I	0.00
207	Parking Lot Southwest	Red	Concrete	Curb	I	0.00
208	Parking Lot Southwest	Red	Concrete	Curb	I	0.00
209	Parking Lot Southwest	Red	Concrete	Curb	I	0.00
210	Parking Lot Southwest	Yellow	Concrete	Curb	I	0.00
211	Parking Lot Southwest	White	Concrete	Curb	I	0.00
212	Building A East Center Exterior	Tan	Concrete	Wall	I	0.00
213	Building A East Center Exterior	Tan	Metal	Elec. Conduit	I	0.00
214	Building A East Center Exterior	Dark Brown	Metal	Awning	I	0.00
215	Building A East Center Exterior	Dark Brown	Metal	Door	I	0.02
216	Building A Southeast Corner Exterior	Forrest Green	Metal	Elec. Box	I	0.00
217	Building A Southeast Corner Exterior	Red	Metal	Pillar	I	3.6
218	Building A South Center Exterior	Dark Brown	Metal	Gutter	I	0.00
219	Building A South Center Exterior	Tan	Concrete	Wall	I	0.08

SURVEY FOR LEAD BASED PAINT
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Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
220	Building A South Center Exterior	Tan	Metal	Pillar	I	0.00
221	Building A West Center Exterior	Tan	Concrete	Wall	I	0.00
222	Building A Space 1A North Center Interior	Yellow	Concrete	Wall	I	0.01
223	Building A Space 1A South Center	White	Drywall	Wall	I	0.01
224	Building A Space 1A North Center	Black	Drywall	Wall	I	0.00
225	Building A Space 1 North Center	White	Drywall	Wall	I	0.00
226	Building A Space 1 East Center	Grey	Wood	Cabinet	I	0.00
227	Building A Space 1 East Center	Grey	Wood	Cabinet	I	0.00
228	Building A Space 1 South Center	White	Metal	I-Beam	I	0.00
229	Building A Space 1 South Center	White	Drywall	Wall	I	0.00
230	Building A Space 1 Northeast Corner	White	Wood	Trim	I	0.00
231	Building A Space 11 North Center	White	Drywall	Wall	I	0.00
232	Building A Space 2 East Center	White	Drywall	Wall	I	0.00
233	Building A Space 2 West Center	White	Wood	Trim	I	0.00
234	Building A Space 4 North Center	White	Drywall	Wall	I	0.00
235	Building A Space 4 East Center	White	Wood	Trim	I	0.00
236	Building A Space 4A East Center	White	Drywall	Wall	I	0.00
237	Building A Space 4A South Center	White	Metal	Door	I	0.00
238	Building A Space 11 South Center	Red	Wood	Mount	I	0.00
239	Building A Space 7 North Center	White	Drywall	Wall	I	0.00

SURVEY FOR LEAD BASED PAINT
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Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
240	Building A Space 7 North Center	White	Wood	Trim	I	0.00
241	Building A Space 11 North Center	White	Concrete	Wall	I	0.00
242	Building A Space 9 North Center	White	Concrete	Wall	I	0.00
243	Building A Space 9 North Center	White	Drywall	Wall	I	0.00
244	Building A Space 9 East Center	Light Grey	Drywall	Wall	I	0.00
245	Building A Space 9 East Center	Snow White	Wood	Trim	I	0.00
246	Building A Space 9 East Center	Light Grey	Drywall	Wall	I	0.00
247	Building A Space 9 North Center	White	Drywall	Wall	I	0.00
248	Building A Space 12 North Center	White	Wood	Door Frame	I	0.00
249	Building A Space 12 North Center	White	Drywall	Wall	I	0.00
250	Building A Space 12 North Center	White	Drywall	Wall	I	0.00
251	Building A Space 12 South Center	White	Wood	Trim	I	0.00
252	Building A Space 1A North Center	White	Metal	I-Beam	I	0.00
253	Building A Space 1A East Center	White	Concrete	Wall	I	0.00
254	Building A Space 18C East Center	White	Concrete	Wall	I	0.00
255	Building A Space 18C North Center	White	Drywall	Wall	I	0.00
256	Building A Space 18C West Center	White	Panel	Panel	I	0.00
257	Building A Space 19 East Center	Grey	Floor	Floor	I	0.00
258	Building A Space 19 North Center	White	Drywall	Wall	I	0.00
259	Building A Space 19 North Center	White	Concrete	Wall	I	0.01

SURVEY FOR LEAD BASED PAINT
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End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
260	Building A Space 19 North Center	White	Wood	Wall	I	0.00
261	Building A Space 19 North Center	White	Drywall	Wall	I	0.00
262	Building A Space 19 South Center	White	Porcelain	Urinal	I	0.02
263	Building A Space 19 Southwest Center	White	Metal	Air duct	I	0.00
264	Building A Space 19 South Center	White	Porcelain	Toilet	I	0.00
265	Building A Space 26 Center	Snow White	Concrete	Floor	I	0.00
266	Building A Space 26 South Center	White	Concrete	Wall	I	0.01
267	Building A Space 26 Center	Red	Concrete	Floor	I	0.00
268	Building A Space 26 South Center	White	Concrete	Wall	I	0.00
269	Building A Space 26 South Center	Pale Green	Concrete	Wall	I	0.00
270	Building A Space 26 Southwest Corner	Clear	Wood	Door	I	0.00
271	Building A Space 15 South Center	White	Concrete	Wall	I	0.00
272	Building A Space 15 North Center	White	Metal	I-Beam	I	0.00
273	Building A Space 15 West Center	White	Drywall	Wall	I	0.00
274	Building A Space 15 Center	Grey	Concrete	Floor	I	0.01
275	Building A Space 15 Center	Grey	Metal	Shelf	I	0.00
276	Building A Space 15 Center	Grey	Concrete	Floor	I	0.00
277	Building A Space 15 West Center	Grey	Concrete	Floor	I	0.00
278	Building A Space 16 East Center	White	Drywall	Wall	I	0.3
279	Building A Space 13 West Center	Grey	Metal	Rail	I	0.00

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Wcsd

Site Name:	Getto Transportation							Date:	8/10/22 & 8/11/22	
Address:	1850 Kleppe Ln. Sparks, NV 89431							FACS Job #:	PJ71737	
Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	

No.	Sample Location	Color	Substrate	Component	Condition	XRF Result (mg/cm2)
280	Building A Space 13 East Center	White	Drywall	Wall	I	0.00
281	Building A Space 13 West Center	Grey	Wood	Stairs	I	0.00
282	Building A Space 13 West Center	Grey	Wood	Stairs	I	0.00
283	Building A Space 28 West Center	Tan	Wood	Door	I	0.00
284	Building A Space 28 North Center	Tan	Wood	Wall	I	0.00
285	Building A Space 28 South Center	Red	Metal	I-Beam	I	0.01
286	Building A Space 28 North Center	Rust	Wood	Cabinet	I	0.00
287	Building A Space 28 North Center	Rust	Wood	Cabinet	I	0.00
288	Building A Space 28 East Center	Brown	Drywall	Wall	I	0.00
289	Building A Space 28 Southeast Center	Tan	Drywall	Wall	I	0.00
290	Building A Space 28 Northeast Corner	Tan	Concrete	Wall	I	0.00
291	Building A Space 28 Northeast Corner	Red	Metal	I-Beam	I	0.01
292	Building A Space 28 Northeast Corner	White	Metal	Door	I	0.00
293	Building A Space 29 West Center	White	Metal	Door Frame	I	0.00
294	Building A Space 29 North Center	Yellow	Metal	Rail	I	0.8
295	Building A Space 28 Northeast Center	Grey	Concrete	Floor	I	0.00
296	Building A Space 30 East Center	Pale Green	Metal	Door Frame	I	0.00
297	Building A Space 31 North Center	Pale Green	Metal	Cabinet	I	0.00
298	Building A Space 30 East Center	White	Drywall	Wall	I	0.00
299	Building A Space 30 West Center	White	Drywall	Wall	I	0.03

SURVEY FOR LEAD BASED PAINT
Wcsd

Site Name:	Getto Transportation							Date:	8/10/22 & 8/11/22	
Address:	1850 Kleppe Ln. Sparks, NV 89431							FACS Job #:	PJ71737	
Start Time:	0800	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	1.0	Technician:	A Cornelius & Z Ramos
End Time:	1515	Calibration:	1.04 =	0.9	1.04 =	0.9	1.04 =	0.9	Inspector/Assessor:	Danny Prado
Niton XLP 300		See Lead-Based Paint Inspections, Sampling Protocol, & Definition of Lead-Based Paint on Page 1							Condition Codes: I = Intact, F = Fair, P = Poor	
No.	Sample Location				Color	Substrate	Component	Condition	XRF Result (mg/cm2)	
300	Building A Space 25 South Center				White	Drywall	Wall	I	0.00	
301	Building A Space 25 East Center				White	Drywall	Wall	I	0.00	
302	End Day Calibration: 1.04=0.9/ 1.04= 0.9/1.04=0.9				-	-	-	-	-	

Appendix C

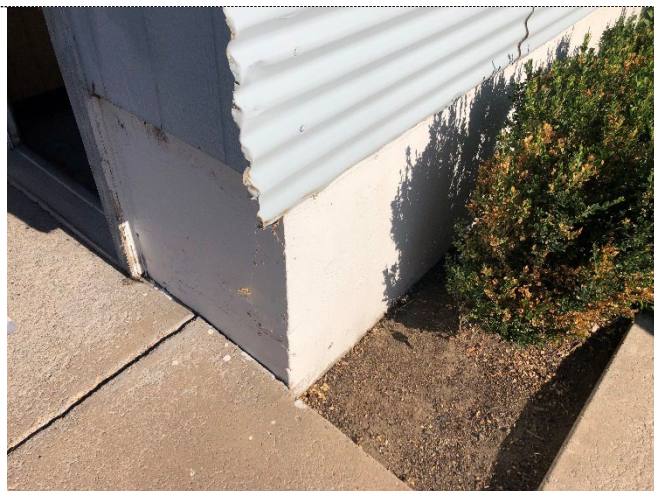
Site Photographs



Concrete Sidewalk



Metal Roof Sealant – Grey



Concrete



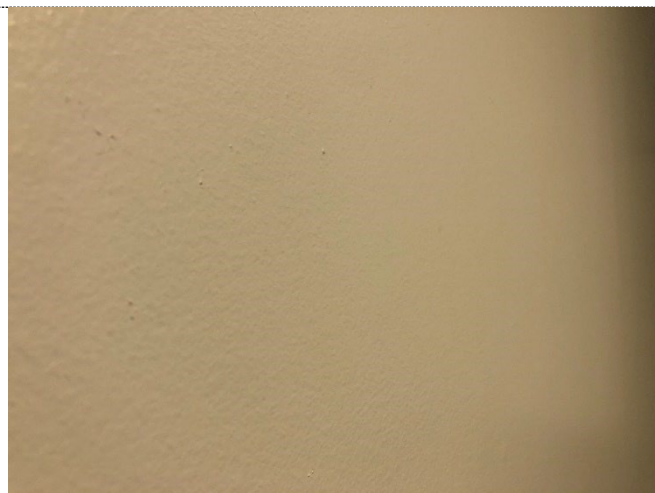
Doorframe Sealant – White



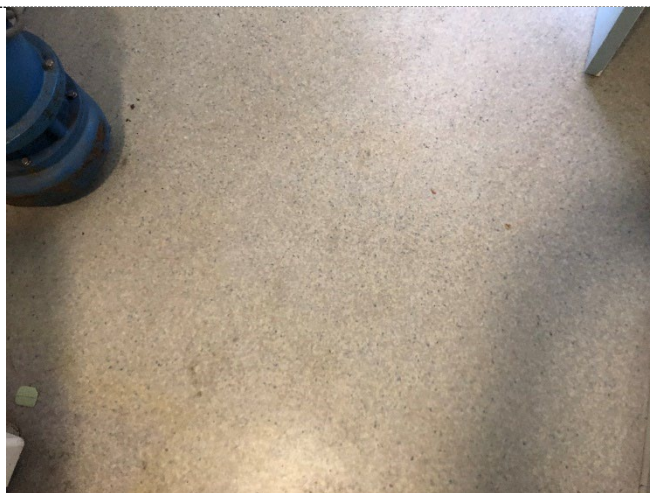
Penetration Mastic – White



Baseboard & Mastic – 4" Black



Drywall Smooth Texture



Linoleum & Glue – Grey Pebble



Baseboard & Mastic – 4" Grey



CMU & Grout



Comp Shingle Roofing – Grey



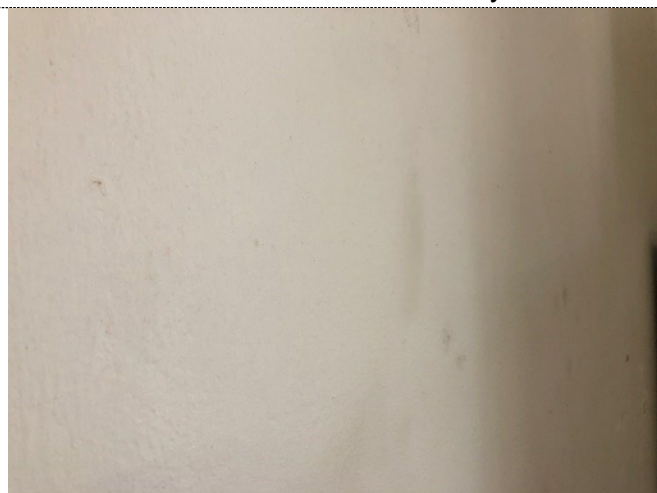
Frame Sealant – White



Penetration Mastic – Grey



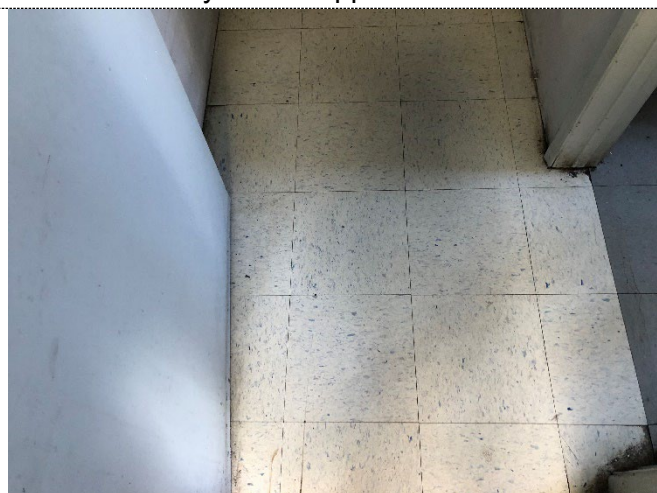
Patch Mastic – Black



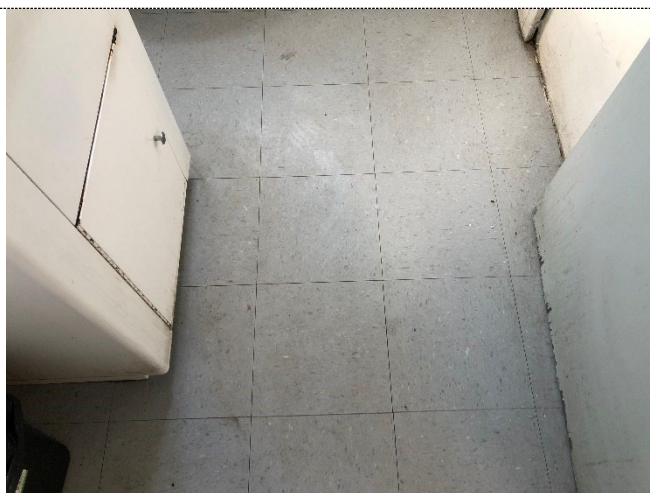
Drywall – Stipple Texture



FCP – 2'x2' Pinhole Fissure



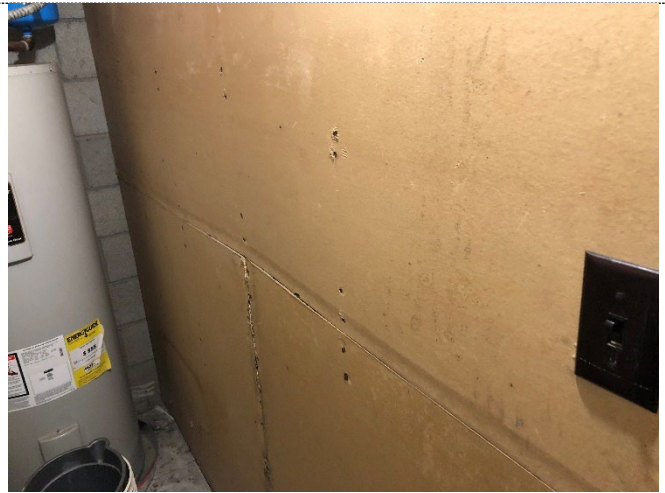
VFT & Mastic – 12" White-Blue Oatmeal



VFT & Mastic – 12" Dark Grey



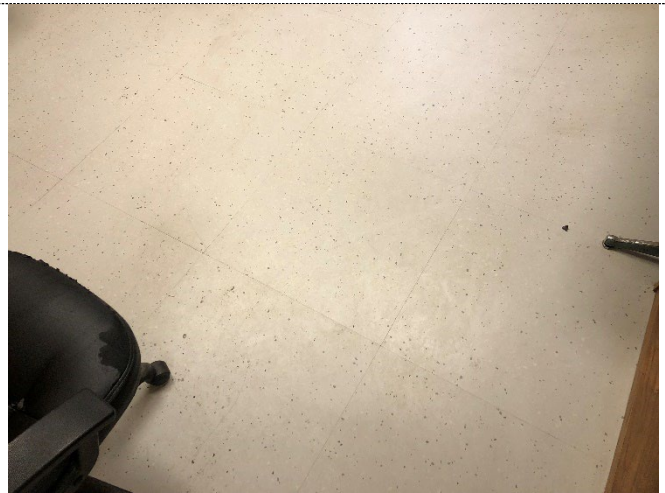
Restroom Sealant – White



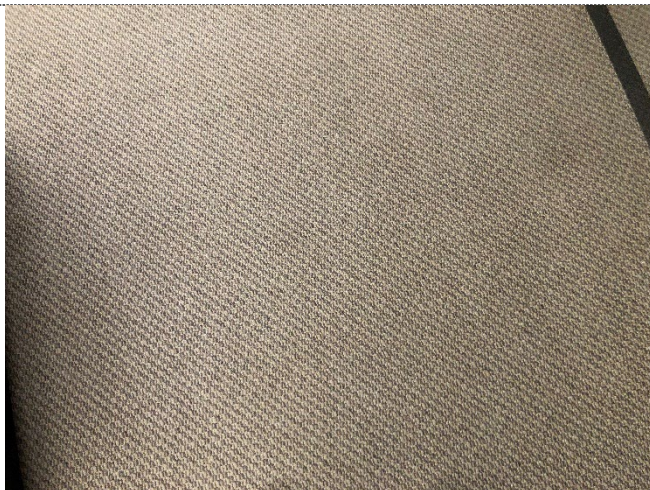
Drywall – Unfinished



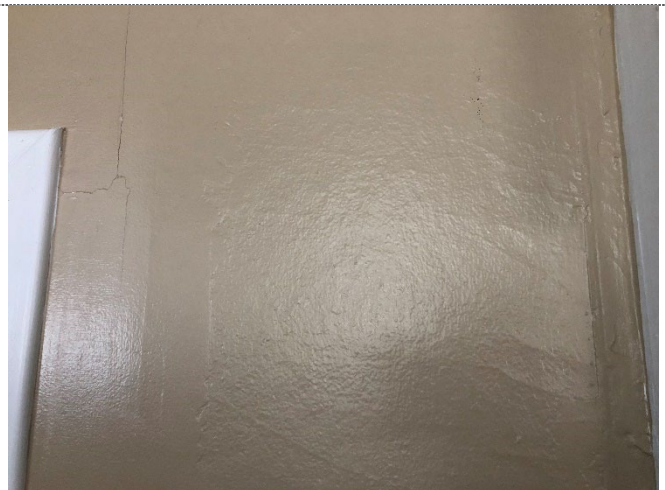
Drywall – Tape & Joint



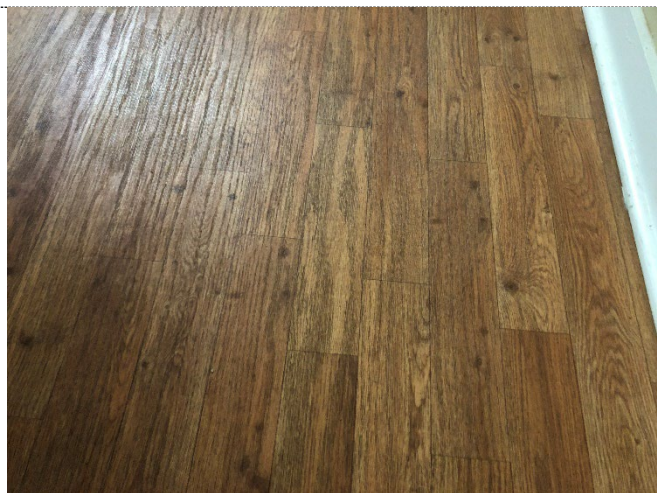
VFT & Mastic – 24" Grey Pebble



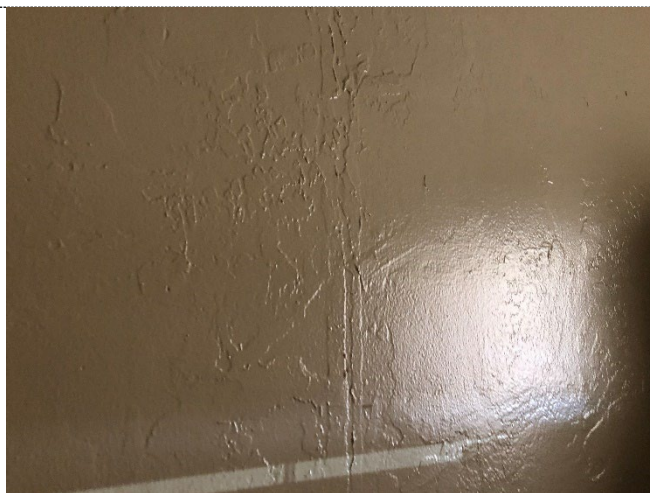
Carpet & Mastic – Tan Squares



Drywall – Orange Peel Texture



VSF & Glue – Faux Wood



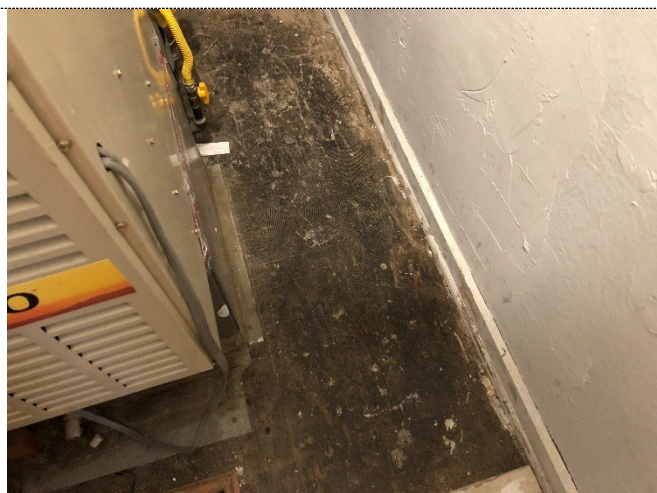
Drywall – Heavy Knockdown Texture



Wood Panels w/Texture



Laminate Flooring & Glue



Mastic – Black



Foil Tape & Glue



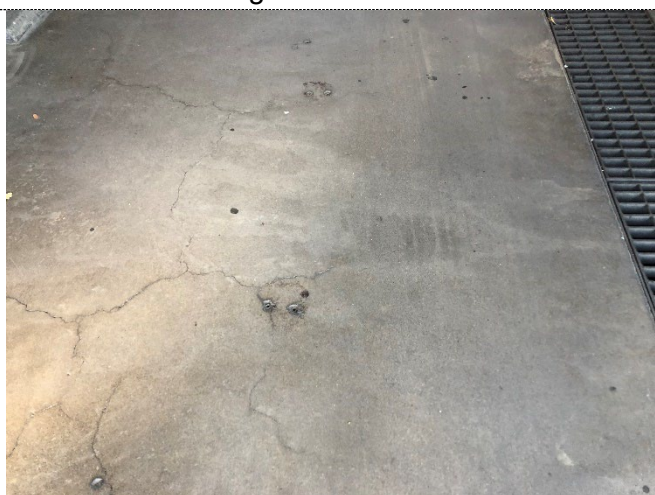
HVAC Mastic – Grey



Siding Sealant – White



Window frame Sealant – Black



Concrete (main buildings)



Fiberglass Pipe Wrap



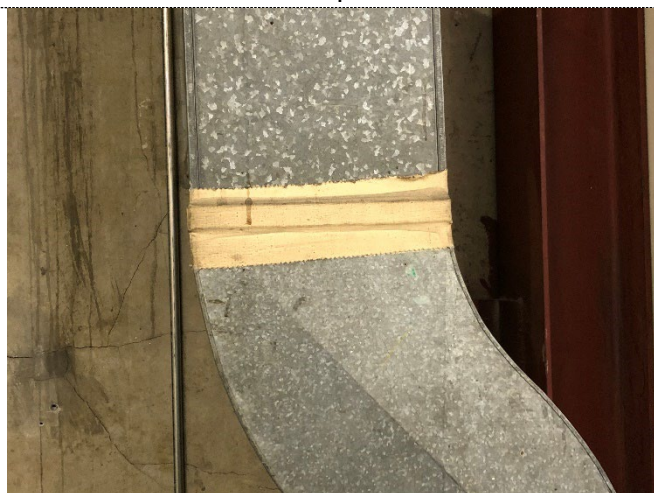
Comp Shingle Roofing – Brown



Vibration Dampener – Black



Expansion Joint – White



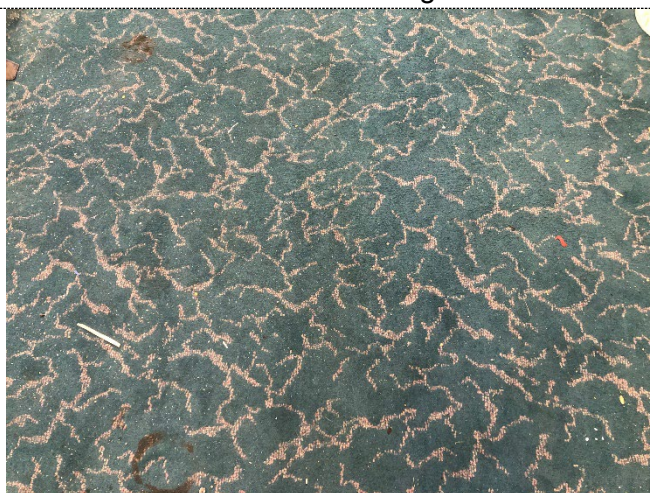
Canvas Duct Tape – Tan



VFT & Mastic – 12" Light Blue



VFT & Mastic – 24" Dark Grey



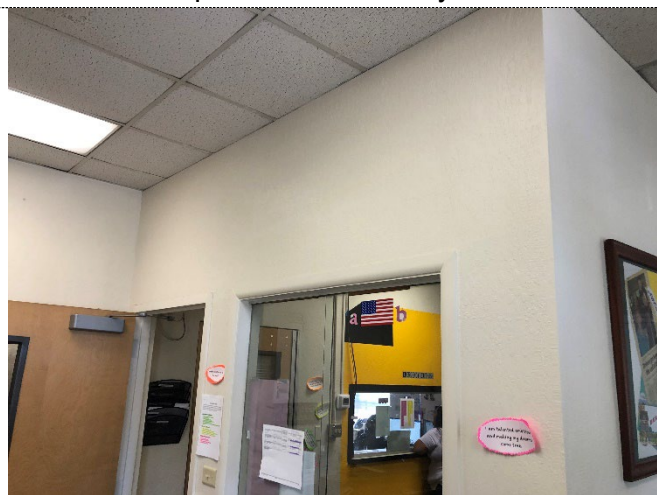
Carpet & Mastic – Green Wave



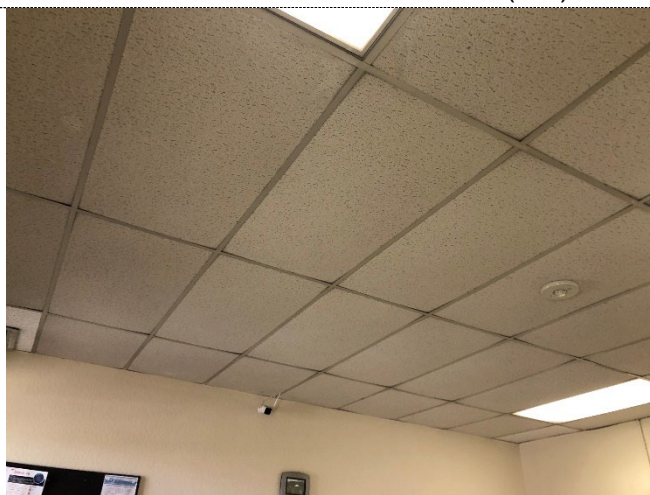
Carpet & Mastic – Grey Multi



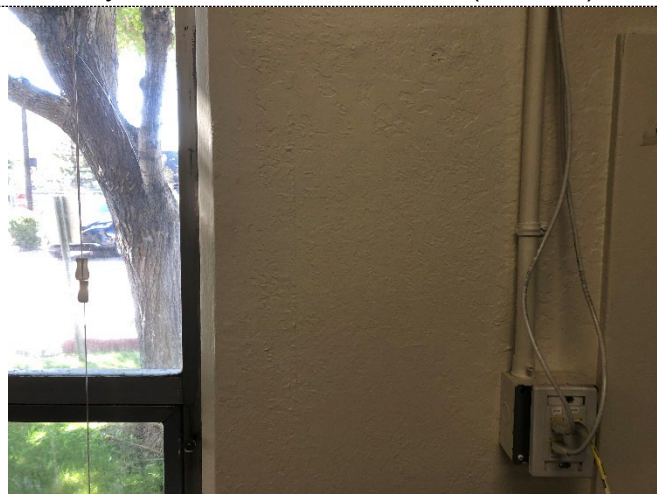
Baseboard & Mastic – 4" Black (MB)



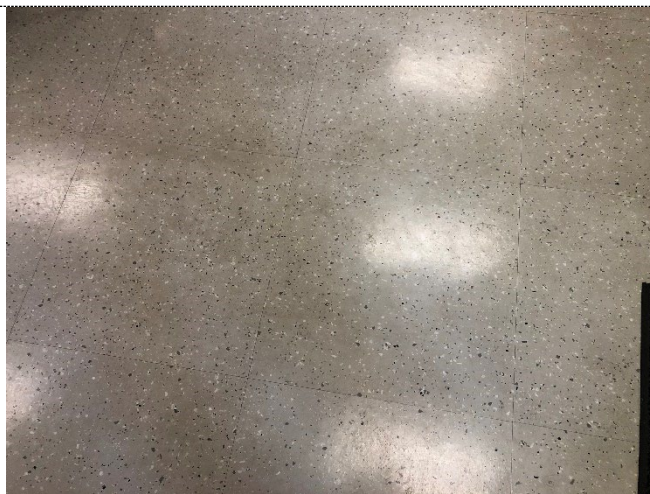
Drywall – Knockdown Texture (1st Floor)



FCP 2'x4' Pinhole Fissure



Concrete w/Texture



VFT & Mastic – 24" Light Grey Pebble



Drywall – Smooth Texture (1st Floor)



Expansion Joint



Epoxy – Grey Pebble



FRP & Glue – White



VFT & Mastic – 12" Beige Oatmeal



Frame Sealant - Tan



Transite Panels (200 Building)



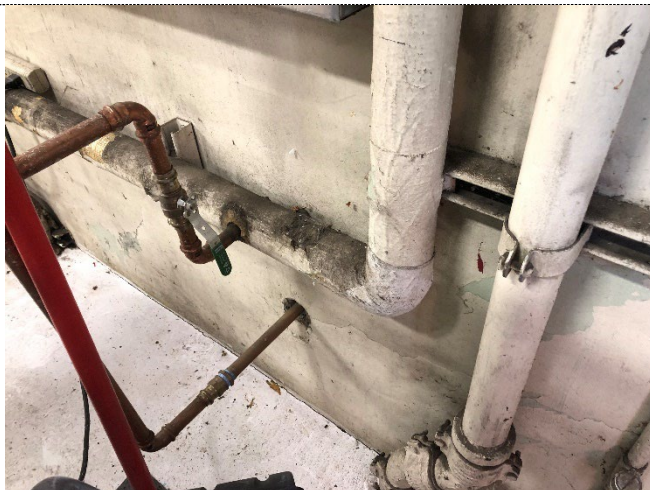
Drywall – Light Knockdown Texture (300 Building)



Fire Doors – 90 Minute Rating



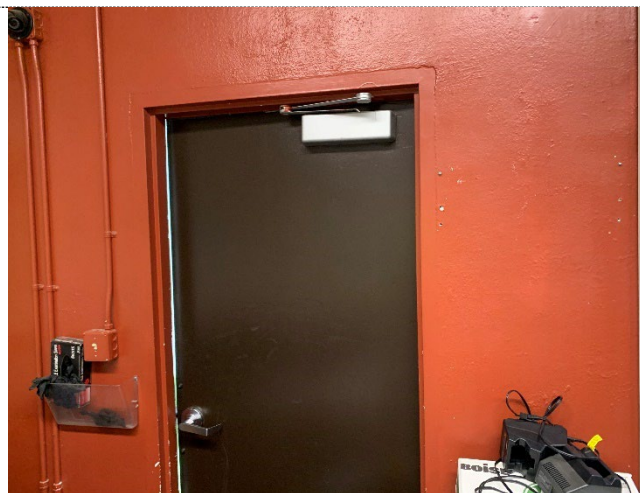
TSI w/Hard Elbows



Hardpack Pipe Wrap



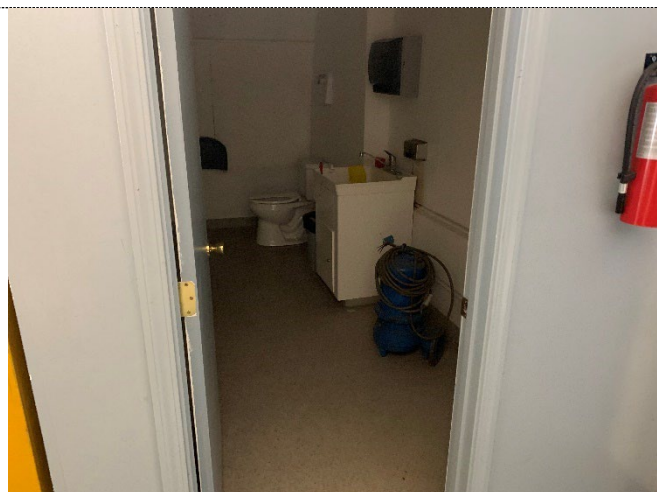
Drywall – Knockdown Texture (2nd Floor)



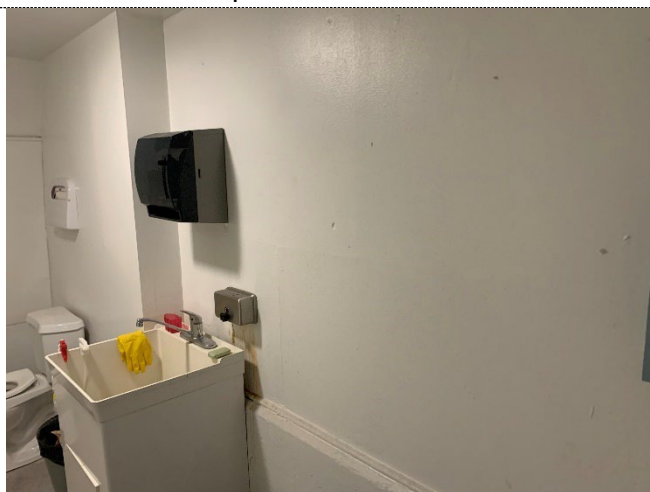
Red paint on concrete wall – Building B



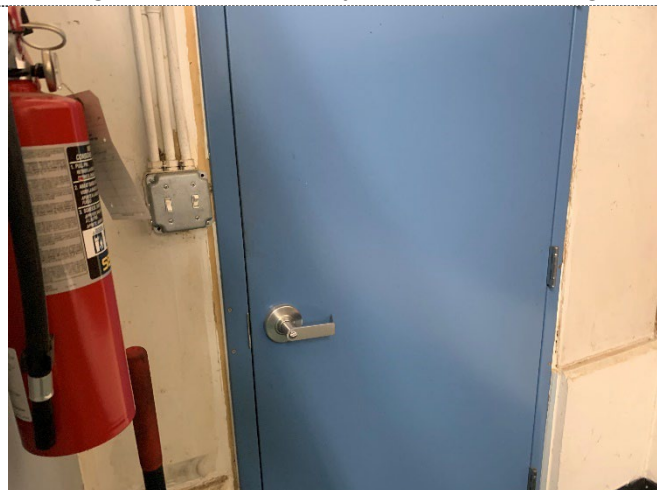
Light blue paint on metal sheeting
White paint on concrete wall



Light blue paint on drywall – 200 Building



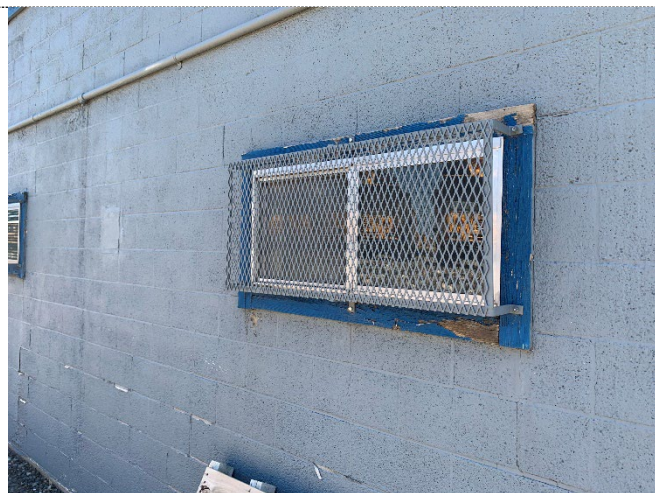
White paint on drywall – 200 Building



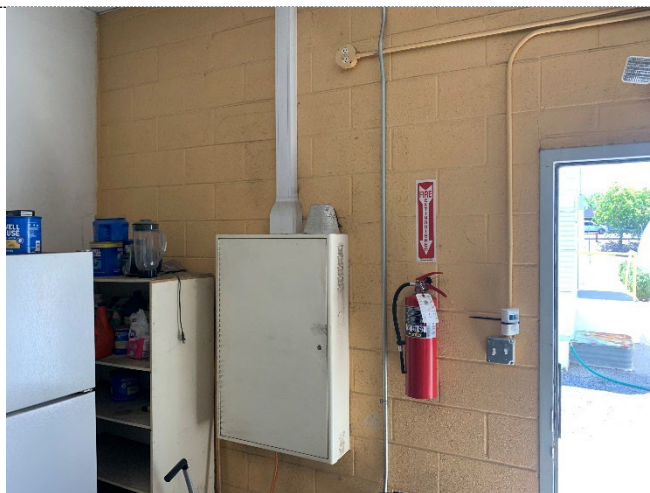
Medium Blue paint on metal door – 200 Building



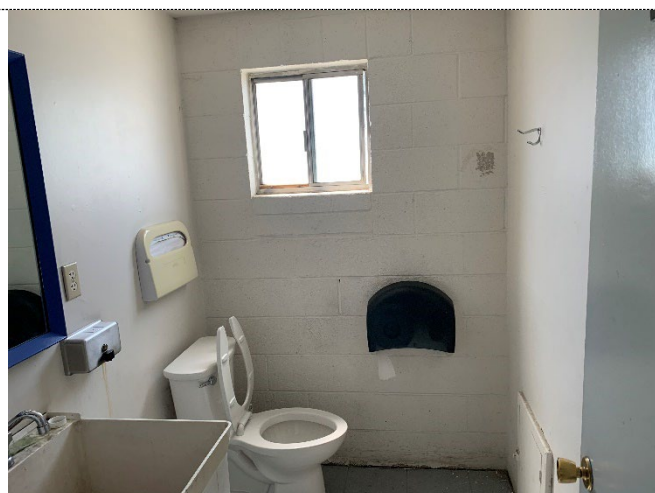
Blue gray paint on CMU – 300 Building



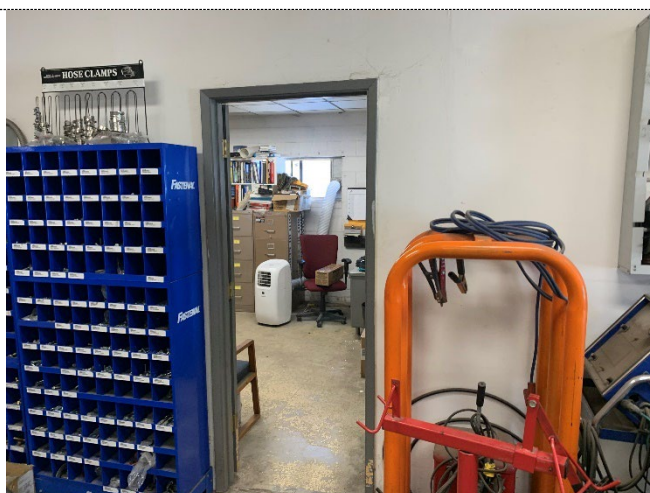
Steel blue paint on wood trim – 300 Building



Yellow paint on CMU – 300 Building



White paint on CMU – 300 Building



Dark gray paint on wood door frame – 300 Building

Appendix D

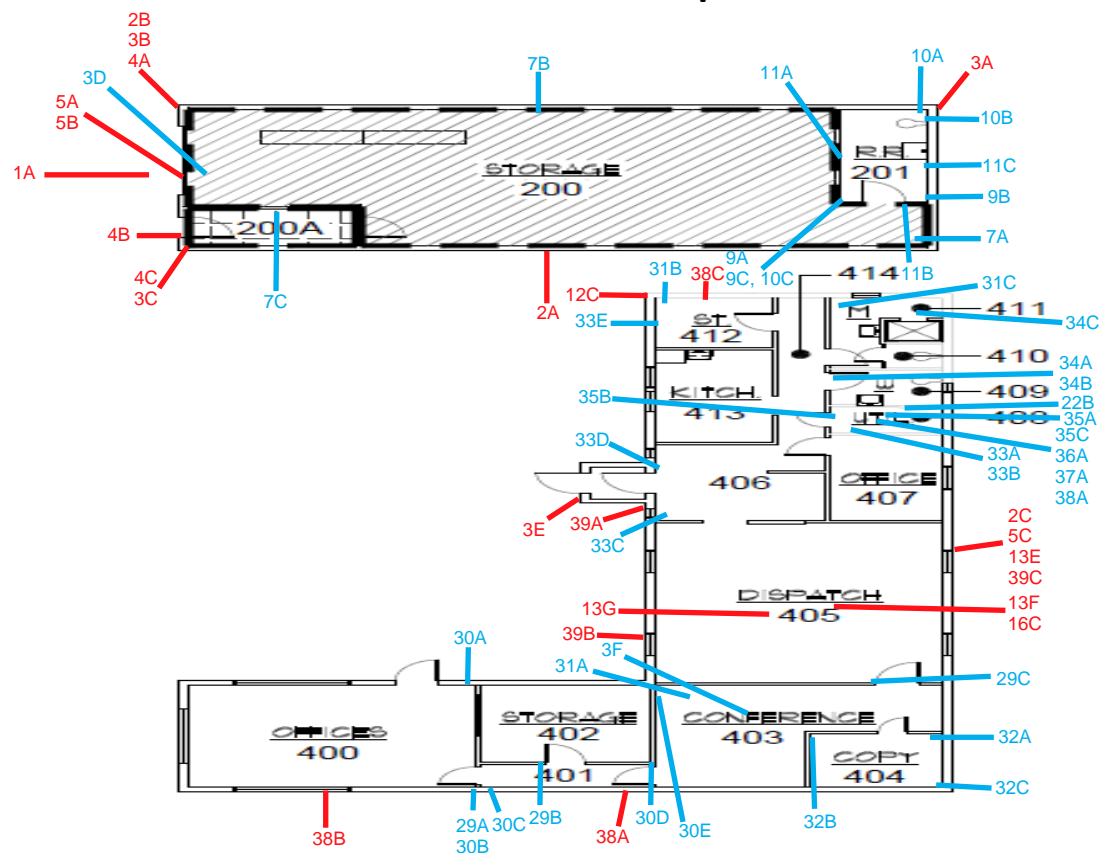
Sample Location Drawings

MAP WITH ASSOCIATED SAMPLE LOCATIONS

Site Name:	WCSD – Getto Transportation
Address:	1850 Kleppe Lane, Sparks, NV 89431
Date:	August 10 & 11 2022



200 & 400 Map



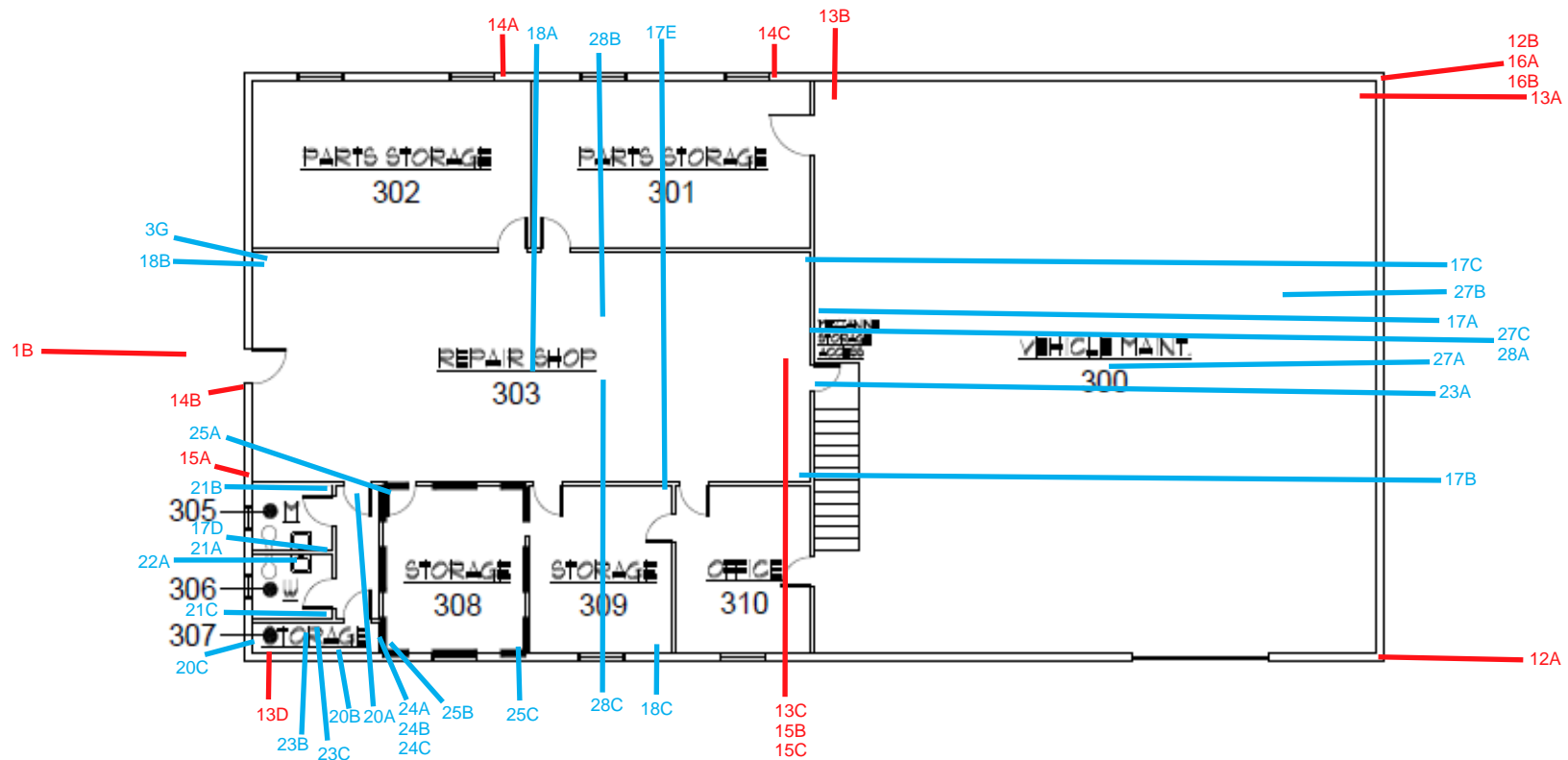
MAP WITH ASSOCIATED SAMPLE LOCATIONS

Site Name:	WCSD – Ghetto Transportation
Address:	1850 Kleppe Lane Sparks, NV 89431
Date:	August 10 & 11 2022



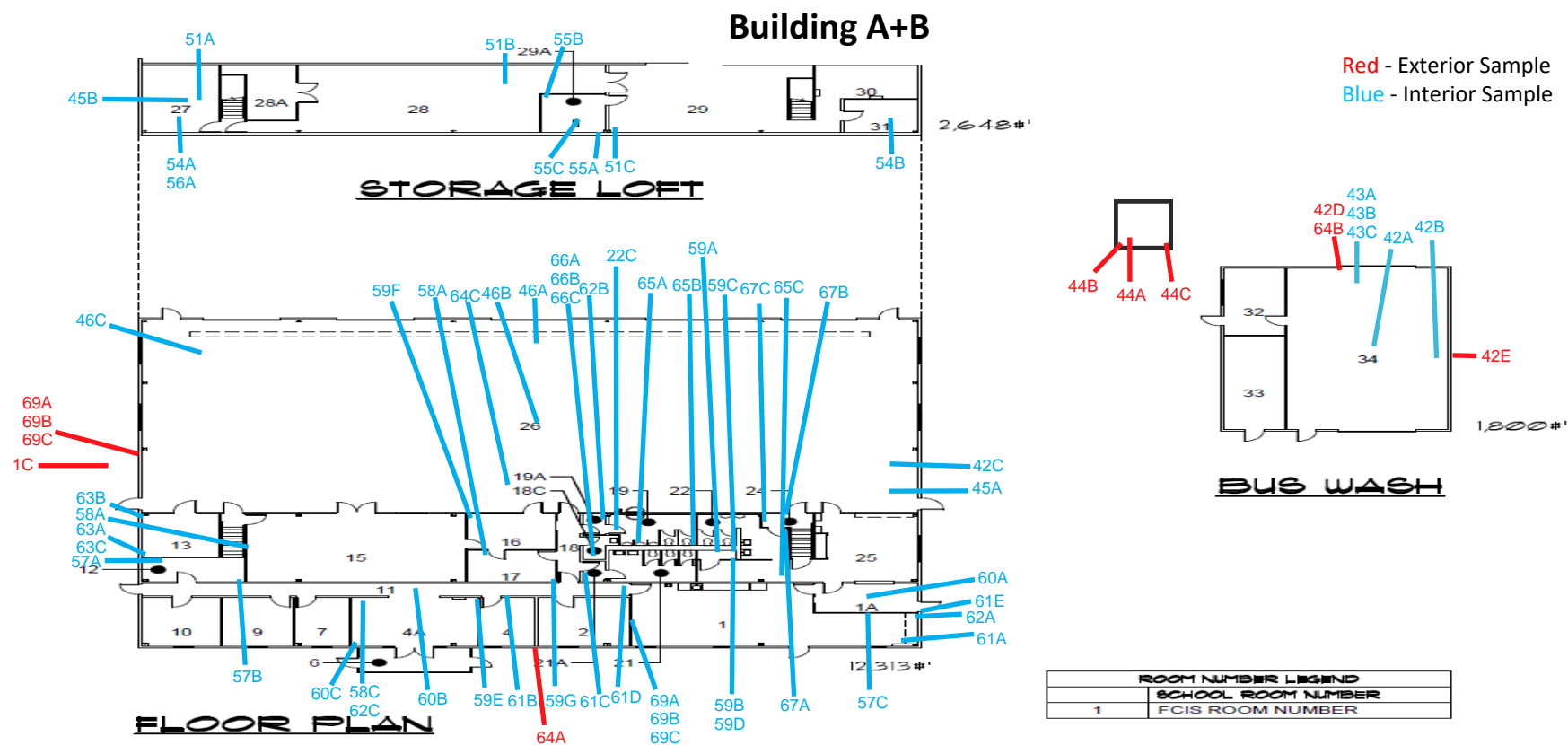
Building 300

Red - Exterior Sample
Blue - Interior Sample



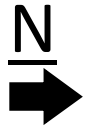
MAP WITH ASSOCIATED SAMPLE LOCATIONS

Site Name:	WCSD – Ghetto Transportation
Address:	1850 Kleppe Lane Sparks, NV 89431
Date:	August 10 & 11 2022

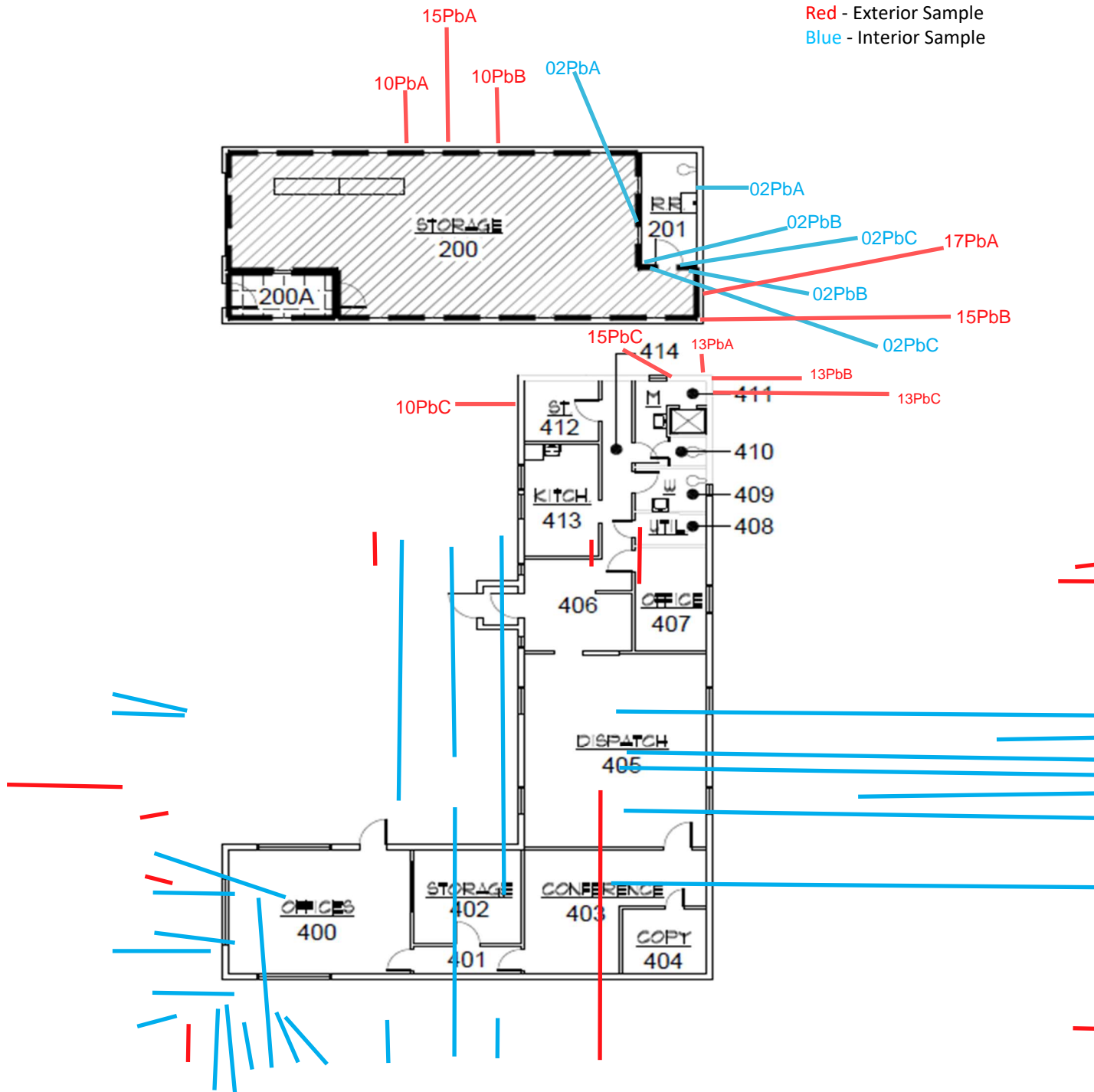


WITH ASSOCIATED SAMPLE LOCATIONS

Site Name:	WCSD – Ghetto Transportation
Address:	1850 Kleppe Lane Sparks, NV 89431
Date:	August 10 & 11 2022



Red - Exterior Sample
Blue - Interior Sample



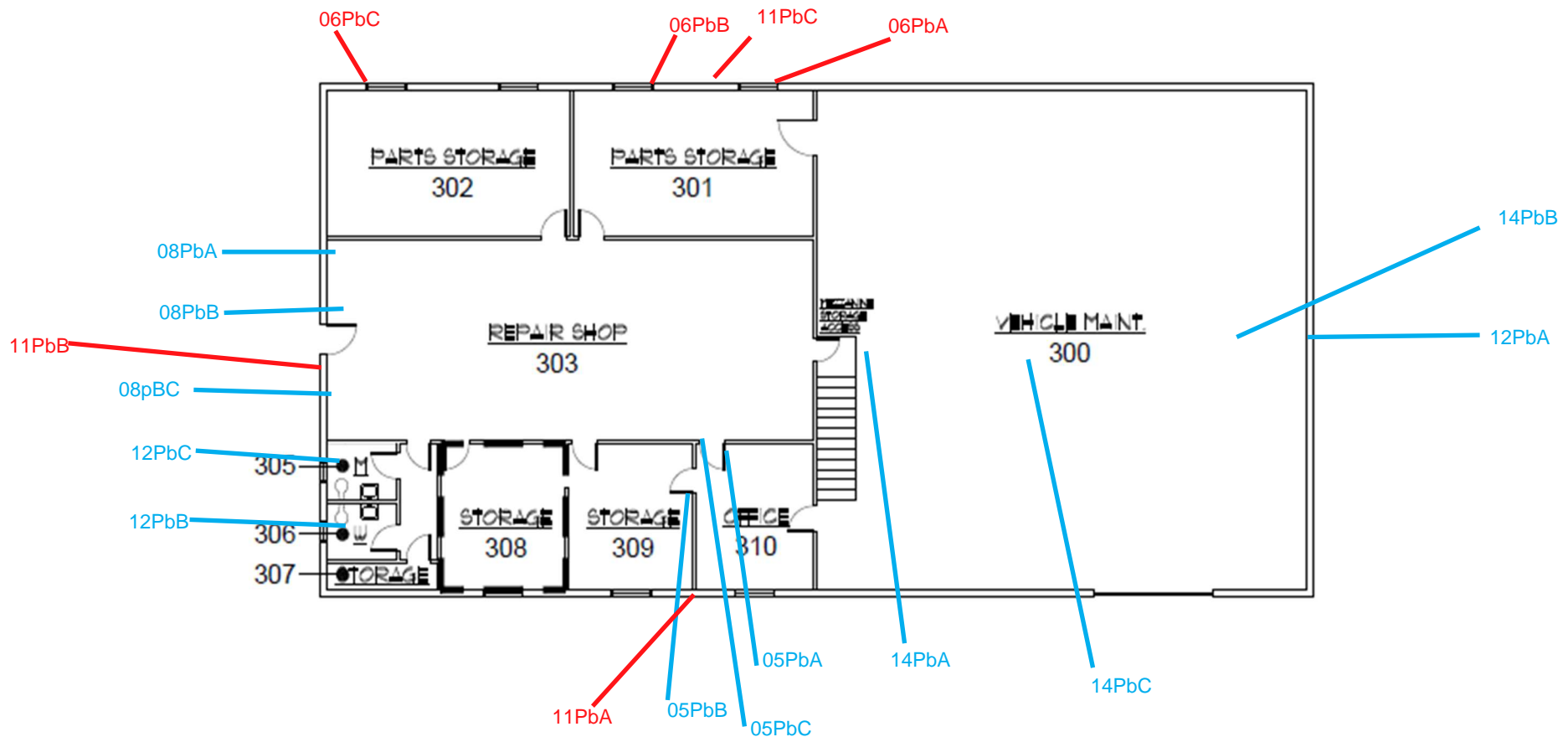
MAP WITH ASSOCIATED SAMPLE LOCATIONS

Site Name:	WCSD – Ghetto Transportation
Address:	1850 Kleppe Lane Sparks, NV 89431
Date:	August 10 & 11 2022



Building 300

Red - Exterior Sample
Blue - Interior Sample



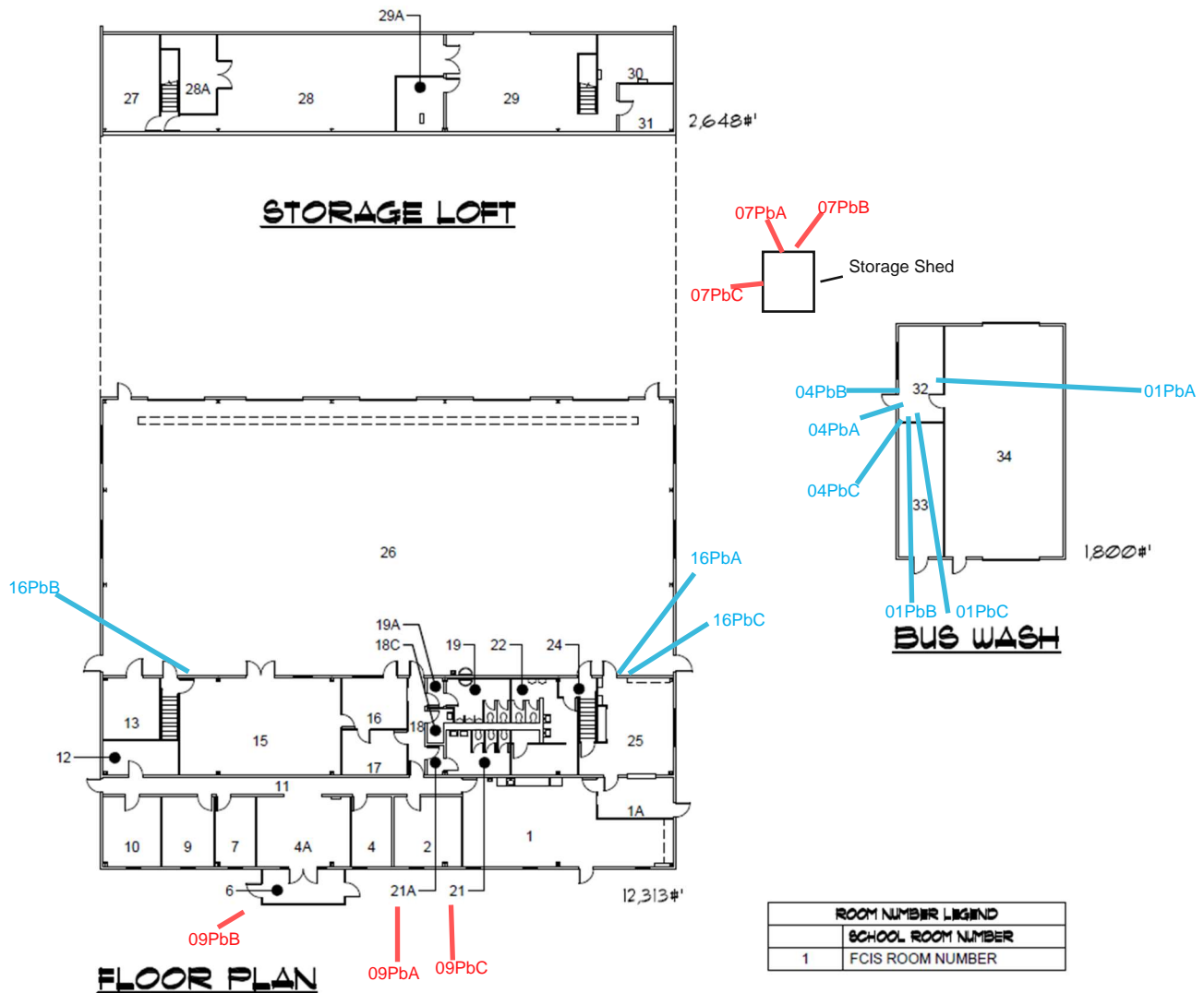
MAP WITH ASSOCIATED SAMPLE LOCATIONS

Site Name:	WCSD- Getto Transpotation
Address:	1850 Kleppe Lane Sparks, NV 89431
Date:	August 10 & 11 2022



Red - Exterior Sample

Blue - Interior Sample



Appendix E

Certifications of Personnel and Laboratories

mm

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
Occupational Safety and Health Administration
Asbestos Control Program

Certifies That Daniel Prado
Forensic Analytical Consulting Services
is Licensed As Asbestos Abatement Consultant

License No. IJPM-2057

Expiration Date 09/10/2022

Signature Of Licensee



Forensic Analytical Consulting Services, Inc.

This is to confirm that

Daniel Prado

Has attended the four-hour

AHERA Refresher Course for Asbestos Inspectors

*And has completed the requisite training and passed the exam for
asbestos accreditation under TSCA Title II*

September 10, 2021

Certificate Number: FACSBIR1146

Valid Until: September 10, 2022

Cal/OSHA Approval Number: CA-025-06

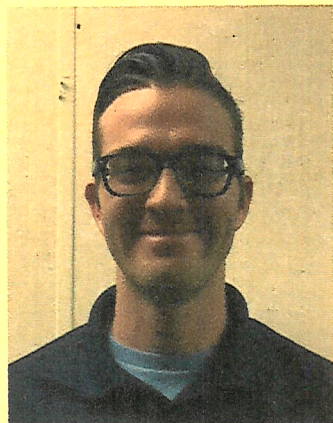


A handwritten signature in blue ink, reading "David B. McGrath", is positioned above the printed name and title of the Corporate Training Director.

David B. McGrath, Corporate Training Director
Forensic Analytical Consulting Services, Inc.
21228 Cabot Blvd, Hayward, CA 94545
(800) 677-1483

United States Environmental Protection Agency

This is to certify that



Daniel J Prado

has fulfilled the requirements of the Toxic Substances Control Act (TSCA) Section 402, and has received certification to conduct lead-based paint activities pursuant to 40 CFR Part 745.226 as:

Risk Assessor

In the Jurisdiction of:

All EPA Administered Lead-based Paint Activities Program States, Tribes and Territories

This certification is valid from the date of issuance and expires May 01, 2023

LBP-R-I214705-1

Certification #

April 17, 2020

Issued On



Adrienne Priselac, Manager, Toxics Office

Land Division

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
mm **Occupational Safety and Health Administration**
Asbestos Control Program

Certifies That Zachary Ramos
Forensic Analytical Consulting Services
is Licensed As Asbestos Abatement Consultant

License No. IM-2341
Trainee

Expiration Date 04/06/2023

Signature Of Licensee



Forensic Analytical Consulting Services, Inc.

This is to confirm that

Zachary E. Ramos

Has attended the twenty-four hour

AHERA Initial Course for Asbestos Inspectors

And has completed the requisite training and passed the exam for

asbestos accreditation under TSCA Title II

April 4 - April 6, 2022

Certificate Number: FACSBII237

Valid Until: April 6, 2023

Cal/OSHA Approval Number: CA-025-05



David B. McGrath, Corporate Training Director
Forensic Analytical Consulting Services, Inc.
21228 Cabot Blvd. Hayward, CA 94545
(800) 677-1483

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
Occupational Safety and Health Administration
Asbestos Control Program

mm
Certifies That Ryan Hettich
Forensic Analytical Consulting Services
is Licensed As Asbestos Abatement Consultant

License No. M-2342
Trainee

Expiration Date 06/03/2023

Signature Of Licensee

Ryan Hettich

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
mm **Occupational Safety and Health Administration**
Asbestos Control Program

Certifies That Alec Cornelius
Forensic Analytical Consulting Services
is Licensed As Asbestos Abatement Consultant

License No. M-2343
Trainee

Expiration Date 06/03/2023

Signature Of Licensee *Alec Cornelius*

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 101459-1

SGS Forensic Laboratories

Carson, CA

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:*

Asbestos Fiber Analysis

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2022-07-01 through 2023-06-30

Effective Dates



A handwritten signature in blue ink, reading "Dana S. Laman".

For the National Voluntary Laboratory Accreditation Program



AIHA Laboratory Accreditation Programs, LLC

acknowledges that

SGS Forensic Laboratories

20535 S. Belshaw Ave Carson, CA 90746

Laboratory ID: LAP-101629

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA LAP), LLC accreditation to the ISO/IEC 17025:2017 international standard, General Requirements for the Competence of Testing and Calibration Laboratories in the following:

LABORATORY ACCREDITATION PROGRAMS



INDUSTRIAL HYGIENE

Accreditation Expires: December 01, 2022



ENVIRONMENTAL LEAD

Accreditation Expires: December 01, 2022



ENVIRONMENTAL MICROBIOLOGY

Accreditation Expires: December 01, 2022



FOOD

Accreditation Expires:



UNIQUE SCOPES

Accreditation Expires:



BERYLLIUM FIELD/MOBILE

Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached Scope of Accreditation. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2017 and AIHA LAP, LLC requirements. This certificate is not valid without the attached Scope of Accreditation. Please review the AIHA LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Cheryl O Morton

Managing Director, AIHA Laboratory Accreditation Programs, LLC

**Right People
Right Perspective
Right Now**

www.forensicanalytical.com

ASBESTOS ABATEMENT TECHNICAL SPECIFICATIONS – EFFECTIVE 1/25/23

PART 1 – GENERAL REQUIREMENTS

1.1 LOCATION

This asbestos abatement is to take place at: Getto Transportation New Facility Project – 1/24

1.2 DESCRIPTION

The work shall include the furnishing of all labor, tools, and equipment, material, transportation, ALL waste disposal fees and services to include waste characterization sampling costs and the performance of all operations required to properly provide the work. The Contractor will be supervised by District AHERA certified personnel or District Hired Asbestos Consultants and the abatement work will be coordinated through the Regulated Systems and Assessment department. The work shall also include obtaining required permits and notifying regulating agencies as required by all applicable state, local and federal laws and regulations for the work to be performed. Notification fees and disposal manifest fees are to be paid by the Contractor. Contractors are reminded that non-friable asbestos projects may not require regulatory notification, but non-friable materials that have been made friable in the opinion of the regulatory agency require notification. Mastics removed with buffers require notification. It is the responsibility of the Contractor to determine if regulatory notification is required and any monetary citations that result from failure to notify or improperly done notifications will be fully the responsibility of the Contractor. Should the District be named in addition to the contractor, due to a Contractor's failure or improper notification, the contractor shall be required to reimburse legal fees to defend the District, as well as the cost of any monetary citation that results. The work shall also include the cleanup and removal from the site of all debris resulting from the operations performed. Waste disposal of all materials removed from the site shall be performed in a manner consistent with these specifications and all applicable regulations and the Contractor is required to complete properly and pay for all waste characterization sampling costs. The Contractor shall be responsible for submitting the application for the waste disposal permit and the contractor will be responsible for the picking up and the payment of the fee for the permit. The Contractor will submit the waste application to the District prior to submittal to the Health Department for signature. It shall also be the Contractor's responsibility to take all necessary safety precautions and to furnish security barricades, and/or any safety measures as may be required to properly separate the abatement areas from the public. All taxes/fees associated with the disposal of asbestos containing wastes, regulated or not, shall be the responsibility of the abatement contractor.

As the District may decide to pay a third party consultant to supervise projects, the District would have to pay the consultant additional money or pay overtime to district employees for weekend and overtime work. The work schedule of this project will be set by the Construction Department Project Manager. If the contractor must work additional time or hours not identified in the initial schedule, due to the contractor's inability to man the job with enough workers, the District may require the contractor to reimburse the district for additional costs for consultants incurred by the District. **The Contractor will be required to staff this project with enough personnel to ensure completion within the required timeline.** The Contractor shall provide at all times sufficient and competent labor to carry on the work

properly and insure completion of each part in accordance with schedule and within the time agreed to. An employee of the Contractor or subcontractor, who is deemed incompetent, disorderly, or otherwise objectionable by the Owner, shall be removed promptly by the Contractor, and not re-employed on the work. Any employee of the Contractor that is observed that is not utilizing his personal protective equipment will be immediately removed from a project and not allowed on any other District projects. Should any disagreements result regarding the identification of the employee or his/her proper use of personal protective equipment, the determination of the District Regulated Systems Supervisor or District hired Consultant will be considered final and conclusive. The Contractors Asbestos Abatement Supervisors who allow employees to not utilize their personal protective equipment will be immediately removed from a project and not allowed on any other District projects. Contractors will be required to replace removed employees/Supervisors and no additional time will be allowed to complete the project.

When possible without the disturbance of asbestos-containing materials, it shall be the responsibility of the **OWNER** to remove and replace all loose and attached furniture, cabinets, bookcases, etc. before the project commences. The removal of these items, where removal impacts asbestos-containing materials, and re-hanging of doors that have to be removed because they impede removal will be the responsibility of the contractor.

The **OWNER** will be responsible for air sampling for the purpose of project clearance. The Contractor shall not include the cost associated with clearance sampling in his bid. The Contractor shall be responsible for all personal and area air monitoring required by regulation, the technical specifications or required by the Contractor's asbestos liability insurance carrier.

The **OWNER** shall be responsible for the cost associated with the initial air sample clearance requirements. If the initial sample analysis results do not pass for clearance, the Contractor will be responsible for the cost of all additional air sample analysis until clearance is achieved. In the case that a project requires the isolation of toilet facilities it shall be the responsibility of the Contractor to provide alternative facilities as needed, if no alternative facilities are available on-site. If the Contractor utilizes District toilet facilities, the Contractor will be required to maintain the cleanliness of the designated District toilet facilities.

The contractor will be required to assign enough personnel and equipment to complete all projects scheduled for completion during each site's normal work hours. Costs to provide access to facilities after normal work hours, due to a Contractors inability to meet the schedule during normal hours will be passed on to the Contractor and deducted from a project's final payment.

There may be supplemental asbestos abatement specifications created by an outside asbestos consultant and provided to the Contractor to provide additional information. The Contractor must refer to all specifications provided in the bid package, and comply with all specification requirements. If there are any conflicts regarding asbestos abatement specification requirements, Contractors are required to comply with the most stringent requirement. Conflicts/disagreements regarding specification requirements will be settled based upon direction from the WCD ES&A Department AHERA Project Designer certified staff.

1.3 EQUIPMENT

If requested the Contractor shall provide proof acceptable to the District that Contractors has disposal is enough equipment to support this project. Delays of up to 48 hours are to be anticipated for TEM Laboratory analysis result turnaround and abatement project schedule will reflect this delay. Additional equipment needs may result and the Contractor will be required to have enough equipment to proceed with work as schedule in spite of delays in awaiting final clearance sampling.

1.4 ASBESTOS LIABILITY INSURANCE REQUIREMENTS

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

1.5 LOCK OUT/TAG OUT PROGRAM

The Contractor will be required to comply with the Districts Lock Out/Tag out procedures. Requirements are available to contacting the WCSD safety officer.

1.6 WORK HOURS

The work schedule of this project will be set by the Construction Department Project Manager. Contractor must determine the work hours by reviewing the other contract documents and specifications or address these issues with the Project Manager so all Contractors are clear of the required abatement schedule prior to bidding on this project. These asbestos abatement specifications are not meant to set work hours or schedules rather the procedures to be used to abate asbestos containing materials within the district. The WCSD, ES&A department will be the entity ensuring the abatement specification are being properly being addressed by Contractors but the day to day scheduling and project specifics, not related to abatement procedures, will be administered by the Construction Department of WCSD.

SECTION 02110

ASBESTOS ABATEMENT: GENERAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications cover the removal of specific types of asbestos containing material for the Washoe County School District. Refer to the project drawing for exact abatement information and locations. The work may include the abatement of asbestos containing material (ACM) on floors. New flooring materials will be installed over abatement areas so mastic removal techniques employed by the abatement contractor are to be done so that installed flooring products are able to be warranted by the flooring manufactures. If the abatement contractor is being hired by a flooring contractor the abatement contractor must consult the flooring installer and ensure their employed removal techniques do not void any warranties for new installed products. It is quite possible that chemical mastic removers may not be able to be utilized to achieve this requirement. No power tools may be used to remove asbestos containing materials unless approved by the District and the applicable regulatory authority. All carpeting in the areas shall be removed and disposed of as ACM, as directed by the District. Work will require use of a negative air pressure system and depending upon personal air sampling may require Type "C" supplied air respirators. Transmission Electron Microscopy (TEM) or Phase Contrast Microscopy (PCM) will be used by the District to establish final airborne asbestos levels prior to acceptance of the work by the District; final levels of airborne asbestos fibers at the completion of the work shall be in accordance with AHERA Regulations (40 CFR Part 763).
- B. Polished Concrete and Concrete Grinding: The district may be grinding and or polishing concrete in scheduled areas after a flooring asbestos abatement project has been completed. In cases that polished concrete will be a part of the scope, **or concrete grinding will be required after abatement**, Contractors will **not** be allowed to utilize solvent mastic removers or any other method that liquefies the matrix of the mastic which could contribute to the mastic entering into cracks, and pores of the concrete. The exception to this would be the use of a fully HEPA vacuum shrouded techniques, such as water jet or hydro blasting. The intent of this requirement is that all mastic will be removed and no liquefied mastics will remain at the conclusion of work. If grinding of the concrete is required, it will happen after the final asbestos air clearance has passed and the asbestos abatement is complete. The poly containment that has been built, during the asbestos abatement phase, might be very helpful and cost effective if it were left in place for the concrete grinding contractor to use. So once the final clearance and abatement contractor has removed all signage, asbestos contaminated materials and the negative pressure machines, the grinding contractor may want to make arrangements with the abatement contractor to leave the poly containment up. All arrangements regarding the logistics of this agreement are up to the contractors' responsibility to determine. Contractors performing concrete grinding will be required to comply with District specifications regarding silica exposure during the grinding phase.

C. INTENT

1. These specifications are intended to describe all material, labor, and equipment necessary for asbestos material removal.
2. The listing or mention of any method of installation, erection, fabrication, or workmanship shall not operate to make the Contractor an agent, but shall be for the sole purpose of setting a standard of quality for the finished work; an alternate method may be approved in writing by the District if it results in quality equal to that intended by these documents, without increasing the District's liability. Unless an alternate method is approved, all work shall be in strict accordance with all methods of installation, erection, fabrication, and ownership listed or mentioned herein. In addition, while the methods are provided, the Contractor will be required to ensure any method utilized complied with all applicable regulations.
3. It is the responsibility of the Contractor to verify the square footage of asbestos containing material that needs to be removed on this project. The Contractor shall remove all asbestos-containing material from the areas as directed.

1.02 DESCRIPTION OF WORK

- A. Furnish all labor, licenses, notifications, payment of notification and waste manifest fees, permits, materials, services, insurance, associated taxes, and equipment to complete and dispose of all asbestos containing materials and asbestos-contaminated material as directed by the District. Base cove materials inhibit the removal process and trap contaminated materials, therefore all removable base cove materials must be removed as a part of the abatement process of flooring materials.
- B. CORRELATION OF DRAWINGS AND SPECIFICATIONS
 1. In general, the specifications will describe the "quality" of the work. The specifications are cooperative and supplementary; however, each item of work is not necessarily mentioned in the specifications. All work necessary to complete the projects so described is to be included in this Contract.
 2. In case of disagreement within the specifications, the better quality of the work shall be estimated and the matter drawn to the District's attention for decision and/or adjustment. Any work done by the Contractor without consulting with the District, when the same requires a decision, shall be done at the Contractor's risk.
 3. Omissions or Errors. If any omissions or errors in technical specifications are noted, or instructions at variance with the obvious intent of the document, it is the responsibility of the Contractor to call them to the District's attention before performing the work.

C. INTERPRETATION OF "OR EQUAL"

1. The use of trade names, with a notation such as "or equal" in these specifications is to establish quality required; there is no attempt to limit competitive bidding, but, in like manner, the quality specified will be rigidly maintained.
2. The words "approved", "equal to", "as directed". etc., are interpreted and will be taken to mean "to the satisfaction of the District."

D. UTILITIES (each of the following apply to this project as stated, unless otherwise noted in the project documents.)

1. Water - Existing service is available for the Contractor's use.
2. Electrical Service
 - a. Existing service is available for the Contractor's use.
 - b. The Contractor shall be responsible for furnishing necessary light bulbs, temporary lighting, temporary power stations, GFI outlets and extension cords as may be essential to the execution of their respective branches of the work. In addition, for extensions of lines to sheds or to power tools and remote areas which cannot be reached with extension cords.
 - c. The Contractor shall be responsible for replacement cost of transformers, panels, circuit breakers and any other item of electrical equipment and installation thereof which is destroyed or broken as a result of or during the course of the Contractor's abatement activity.
3. Utility charges for electric power and water service will be paid by the Owner.

E. GUARANTEE

1. The Contractor shall, in case of work performed by his Subcontractors and where guarantees are required, secure warranties from said Subcontractors and deliver copies of same to the District upon completion of the work and prior to final retention payment.
2. All portions of the work shall also be maintained in perfect condition during this period. Such written guarantees as may be requested shall be submitted in duplicate at the completion of the work. These will be supplementary to and not in any way canceling specific guarantees which apply to various portions of the work.
3. If, in the Contractor's opinion, any work that is called for in the specifications in such a manner as to make it impossible for him to produce and guarantee a first-class piece of work, he shall refer the same to the District in a timely manner before proceeding.

1.03 DEFINITIONS

A. GENERAL TERMINOLOGY FOR ASBESTOS ABATEMENT

1. Owner - Washoe County School District, hereinafter referred to as the Owner, or the District, or the authorized representative of the Owner, or the District's consultant.
2. Authorized Visitor - Any visitor to the site whose visit has been authorized by the District.
3. Asbestos - The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite. Materials are considered to contain asbestos if any amount of asbestos is present.
4. ACM - Asbestos-containing material(s).
5. Visible Asbestos - Visible Asbestos Containing Material
6. Abatement - Procedure to control fiber release from asbestos-containing building materials. Includes encapsulation, enclosure and removal.
7. Removal - All herein specified procedures necessary to strip all ACM from the designated areas and to dispose of these materials at an acceptable site. **The preferred method of removal of flooring material mastic is by wet method utilizing a chemical mastic remover.**
8. Work Area - A room or location in which ACM is indicated to be removed by this Contract.
9. Containment Area - A work area or zone which is prepared with plastic sheeting, barriers, negative air, etc., for asbestos abatement work.
10. Enclosure - All herein specified procedures necessary to completely enclose all ACM behind airtight, impermeable, permanent barriers.
11. Encapsulation - All herein specified procedures necessary to treat ACM with an encapsulant to control the possible release of asbestos fibers into the ambient air.
12. Encapsulant (Sealant) - A liquid material which can be applied to ACM and which controls the possible release of asbestos fibers from the material either by creating a membrane over the surface (bridging encapsulant) or by penetrating into the material and binding its components together (penetrating encapsulant). Any encapsulant installed must be compatible with any new products that will be installed over the encapsulated such as flooring products.
13. Air Monitoring (Air Sampling) - The process of measuring the fiber content of a specific volume of air in a stated period of time.

14. Area Monitoring - Air monitoring of fiber concentrations within the asbestos control area and outside the asbestos control area which is representative of the ambient airborne concentration of fibers.
15. Personal Monitoring - Air monitoring of fiber concentrations within the breathing zone of an employee.
16. HEPA Filter - A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of particles greater than 0.3 micron in size.
17. Negative Air Pressure System - A local exhaust system capable of maintaining a minimum pressure differential of minus 0.03 inch of water gauge in work area relative to adjacent areas. Documentation of negative air pressure is mandatory.
18. Negative Air Machine (NAM, "HOG") - A self-contained local exhaust machine utilized in a negative air pressure system. This equipment must use HEPA filters when used in asbestos work areas to collect and retain asbestos fibers.
19. HEPA Filter Equipment - Vacuuming equipment, which uses HEPA filters capable of collecting and retaining asbestos fibers. Filters shall be of 99.97% efficiency for retaining fibers of 0.3 micron or larger in size.
20. Surfactant - A chemical wetting agent added to water to improve penetration.
21. Amended Water - water to which a surfactant has been added.
22. Removal Encapsulate - a penetrating encapsulate specifically designed for removal of asbestos-containing materials rather than for on site encapsulation.
23. Chemical Remover - A pre-mixed chemical-penetrating agent designed specifically for removal of asbestos-containing material.
24. Airlock - A system for permitting ingress or egress without permitting air movement between a contaminated area and an uncontaminated area, typically consisting of two curtained doorways.
25. Curtained Doorway - Device to allow ingress or egress from one room to another while permitting minimal air movement between the rooms
26. Decontamination Facilities - A series of connected rooms, with doorways between any two adjacent rooms, for the decontamination of workers or of materials and equipment. The facility minimally consists of a clean room, a shower room, and an equipment room.
27. Clean Room - An uncontaminated area or room, which is part of the worker decontamination facility, with provisions for storage of workers' street clothes and clean or unused protective equipment.

28. Shower Room - A room between the clean room and the equipment room in the worker decontamination facility, with hot and cold running water, soap, shampoo, and suitably arranged for complete showering during decontamination.
29. Equipment Room - A contaminated area or room that is part of the worker decontamination facility, with provisions for storage of contaminated clothing and equipment.
30. Wet Cleaning - The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as asbestos-contaminated waste.
31. Water Filtration System - A local water-filtering system capable of trapping and retaining 99.9% of asbestos fibers greater than 5 micron in size.
32. Fixed Object - A unit of equipment or furniture in the work area which is not removed from the work area. To include chalk boards, bulletin boards, TV stands etc.
33. Movable Object - A unit of equipment or furniture in the work area, which can be feasibly removed from the work area without disassembly.
34. MSDS - Material Safety Data Sheet - OSHA Form 20 or equivalent form containing health hazard information about chemical products.
35. NESHAPS - The National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61).
36. NIOSH - National Institute for Occupational Safety and Health.
37. OSHA - Occupational Safety and Health Administration.
38. EPA - Environmental Protection Agency.
39. ASTM - American Society for Testing and Materials.
40. ULI - Underwriters Laboratories, Inc.
41. Chemical Mastic Remover - A non-flammable solvent manufactured especially for the removal of mastic materials. **The flash point of the mastic remover used on District projects must be no less than 140 degrees Fahrenheit.**

PART 2 - APPLICABLE STANDARDS AND GUIDELINES

2.01 REFERENCE DOCUMENTS AND RESOURCES

- A. All work covered by these regulations shall be performed in accordance with all applicable federal, state, and local regulations, standards, and codes governing asbestos abatement, transportation, and disposal. The current issue of each document shall govern. Where conflict among requirements or with these specifications, the more stringent requirements shall apply. Requirement shall include but not be limited to:
- B. Department of Transportation
 - Title 49 CFR 172 – Special Provisions, Hazardous Materials Communications, Emergency Response Information and Training requirements.
 - Title 49 CFR 173 – General Requirements for Shipments and Packaging.
- C. Environmental Protection Agency (EPA)
 - Title 40 CFR, Part 763, Asbestos Containing Materials in Schools (AHERA)
 - Title 40 CFR 61, Subparts A & M – National Emission Standard for Asbestos (Neshaps)
 - Title 40 CFR, Part 763 – Revised Model Accreditation Plan
- D. Federal Occupational Safety and Health Administration (OSHA)
 - Title 29 CFR 1910.20 – Access to Employee Exposure and Medical Records
 - Title 29 CFR 1910.38 – Emergency Procedures
 - Title 29 CFR 1910.134 – Respiratory Protection
 - Title 29 CFR 1926.20 – General Safety and Health Provisions
 - Title 29 CFR 1926.21 – Safety Training and Education
 - Title 29 CFR 1926.23 – First Aids
 - Title 29 CFR 1926.24 – Fire Protection
 - Title 29 CFR 1926.25 – Housekeeping
 - Title 29 CFR 1926.28 – Personal Protective Equipment
 - Title 29 CFR 1926.51(f) – Washing Facilities
 - Title 29 CFR 1926.55 – Gases, Vapors, Fumes, Dusts, and Mists
 - Title 29 CFR 1926.56 – Illumination
 - Title 29 CFR 1926.57 – Ventilation
 - Title 29 CFR 1926.59 – Hazard Communication Standard
 - Title 29 CFR 1926.103 – Respiratory Protection
 - Title 29 CFR 1926.300, 301, 302 – Hand and Power Tools
 - Title 29 CFR 1926.451 – Scaffolding
 - Title 29 CFR 1926.500, 502, 503 – Fall Protection
 - Title 29 CFR 1926.1101 – Asbestos Standard for the Construction Industry

- E. Nevada Division of Environmental Protection (NDEP)
- NAC 444.965 to 444.976 – Sanitation of Asbestos
- F. Nevada Occupational Safety and Health Enforcement Section (OSHES)
- NAC 618.850 to 618.907 – Abatement of Asbestos, General Provisions
 - NAC 618.910 to 618.948 – Abatement of Asbestos, Licensing and Accreditation to Perform Services
 - NAC 618.950 to 618.962 – Abatement of Asbestos, Performance of Activities for Abatement
 - NAC 618.970 to 618.986 – Abatement of Asbestos, Disciplinary Action
- G. Washoe County District Health Department, Environmental Health Services Division. (WCHD)
- 030107A to 030.107C – District Board of Health Regulations Governing Air Quality Management (regarding asbestos)
 - 030.184 to 030.185 - District Board of Health Regulations Governing Solid Waste Management
- H. STATE AND LOCAL REQUIREMENTS
1. The Contractor shall comply with the State of Nevada, Division of Occupational Safety and Health Regulations for construction and handling of asbestos. All Contractor personnel will have the applicable Nevada OSHES card on their person at all times during the completion of the project. Personnel will be required to present the license to District personnel upon request. Personnel without their Nevada OSHES card, or with unreadable or mutilated cards, or expired cards will not be allowed to work on the project until a readable, unexpired card is produced.
 2. The Contractor shall comply with the Federal Environmental Protection Regulations pertaining to handling and disposal of asbestos-containing materials as well as the State of Nevada and any local governmental agencies which have delegated responsibility for the administration and enforcement of NESHAPS and other federal regulations.
 3. The Contractor shall comply with all requirements of the EPA approved landfill which is selected as the disposal site.
- I. OTHER REQUIREMENTS
- ANSI - American National Standards Institute: ANSI Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems.
- J. The Contractor shall comply with said regulations, requirements, and standards (noted in B through I) and require and be directly responsible for compliance therewith on the part of his agents, employees, and subcontractors; and shall directly receive and be responsible for all citations, assessments, fines or penalties which may be incurred by reason of his agents, employees, or subcontractors failing to so comply.

PART 3 - REQUIRED DOCUMENTATION

3.01 SUBMITTALS AND NOTICES

A. PRIOR TO COMMENCEMENT OF WORK, ALL THE FOLLOWING MUST BE SUBMITTED TO THE WCSD, ES&A DEPARTMENT

1. Notification in writing of proposed asbestos work, with copy to the WCSD, ES&A Department, the EPA Regional Office, OSHA or OSHA Regional Office, local air pollution agency, and local authority with responsibility for enforcement of occupational health and safety regulations and enforcement of NESHAPS regulations and with jurisdiction in the State in which this project is located, not fewer than ten (10) working days before work commences on this project. Courtesy notifications will be submitted on **all** projects regardless of the regulatory requirement.
2. Submit proof satisfactory to the WCSD, ES&A Department that all required permits, site locations, and arrangements for transport and disposal of asbestos-containing materials, supplies and the like have been obtained.
3. Submit documentation to the WCSD, ES&A Department indicating that all employees have had medical examinations (See Section 02110, PART 3, 3.01, B, 6) and instruction on the hazards of asbestos exposure, use of protective clothing, on use of showers, on entry and exit from work areas, on work procedures and protective measures, and on all aspects of 29 CFR 1910.134 (See also Section 02130, PARTS 3 and 4).
4. Submit documentation to the WCSD, ES&A Department that fifty (50) percent of the work force (exclusive of job foremen, superintendents, etc.) have at least one year's experience in asbestos abatement work for any employee not already approved and verified.
5. Submit to the WCSD, ES&A Department documentation that all superintendents, and supervisors have been certified as supervisors for at least two (2) year's and possess two (2) years' experience supervising asbestos abatement projects in that capacity for any employee not already approved and verified.
6. Submit documentation that **all** of the work force members are licensed by the State of Nevada in the field of asbestos control. Personnel will be required to present the license to District personnel upon request. Personnel without their Nevada OSHES card, with unreadable or mutilated cards, or expired cards will not be allowed to work on the project until a readable unexpired card is produced.
7. Submit documentation that each negative air machine and HEPA vacuums have been "thermally DOP tested" by a "third party" testing agency within a 6 month period prior to the start of each project. The "third party" testing must be conducted by a testing agency with its own testing equipment and may have no relationship with the contractor. The District's decision regarding the issue of when a testing agency meets the "third party"

requirement will be regarded as final and conclusive. The Contractor will be required to submit DOP test result certification for each unit prior to its use. The DOP testing company will be required to strictly comply with the manufacture procedures and testing media. The District may require access to review the DOP testing conducted during the contract period. **Any negative air machine or vacuums that are to be exhausted outside of a negative pressure enclosure must be DOP tested on-site prior to the start of any project. In addition equipment inside a containment larger than 2000 square feet will require on-site DOP testing of all negative air machines and vacuums prior to the start of the project.** Contractor will be required to add this delay for DOP testing into the project schedule and supplement the workforce accordingly to maintain the required abatement schedule.

8. Submit documentation that each negative air recording device (manometer) has been calibrated within 12 months prior to the start of each project.
 9. Various manufacturers' information, including MSDS's, for approval, prior to its use on any project. In addition to submitting a copy to the ES&A department, Contractors will also be required to provide to the site's administration office and the Site Coordinator (head custodian) one complete copy of all MSDS's for all chemicals used on site.
 10. Proof of insurance coverage prior to the start of each project.
 11. Submit documentation from the Contractors asbestos liability insurance company, information on all area and personal area monitoring requirements. A complete copy of the insurance policy including any riders must be provided.
 12. Submit documentation to the District indicating that all employees have taken the required AHERA training for the type of work they will be performing. Legible copies of each employee's initial training class and copies of the most recent refresher must be submitted. All employees will be required to have in their possession when performing abatement work the original copies of the initial training and refresher training certificates. District inspectors will review certificates in the field. Personnel without their AHERA training certificates, with unreadable or mutilated certificates, or expired certificates will not be allowed to work on the project until a readable initial or unexpired refresher certificate is produced.
- B. The following procedure is to be implemented in an effort to reduce the time and cost to submit worker/employee training certs, Nevada State license, and physical documentation, items #3, #6 and #12 listed above. The required compliance will reduce the time the Contractor must put forth submitting training/physical documents as well as reduce the time it takes to review and approve the documents submitted. Contractors **will not** submit duplicate documentation to the ES&A department or representatives in the field that the ES&A department already has on file. Contractor can request a complete list of documents the ES&A department has on-file by calling the ES&A department at 851-5675 and one will be provided.

1. **At least two weeks prior to the start of the project**, contractor shall provide all worker/employee training certs and physical documentation for employees not already in the WCSD training database, to the ES&A Department at 7495 South Virginia Street, Reno, Nevada. To do this electronic copies will be provided through e-mail to the ES&A department Administrative Secretary. Contact the ES&A department Administrative Secretary. At 851-5675 if you do not their e-mail address. The ES&A Department will review the submitted training documentation and pre-approve workers and supervisors so they can work on the assigned WCSD project.
 2. New workers added to the project after the start of the project will be approved by the ES&A department within one 8 hour period of the standard Monday thru Friday normal work schedule. Certification submittal will be serviced by the ES&A Department on a first come, first served basis. Delays to review the documentation will be anticipated and taken into account on any project schedule developed.
 3. Workers or technicians will not report to the job site until they have been added to the ES&A database and properly documented on the contractors training report which is provided to ES&A or lead supervisory consulting staff in the field. ny way that requires certification on that project.
 4. Contractors should request and will be provided a copy of the most current WCSD Company Training Report for their company which will identify training and physical documentation on file with WCSD for each employee. This database should be kept current by perspective bidders by providing to the ES&A department any new documentation when it is received for their employee so no delays are encountered due to a contactor not keeping this companies documentation current. Do not wait till you get a bid to provide updated data for your employees otherwise delays can occur.
 5. ES&A staff in the field or environmental lead consulting staff will not be allowed to let anyone work or show up to the job site of they are not up to date on their documentation as identified on the WCSD Company Training Report.
- C. The Contractor shall submit to the WCSD, ES&A Department, upon request, any other information the District may require, including, but not limited to, the following:
1. Weekly work schedule.
 2. Type and brands of materials for worker protection.
 3. Method of application and materials to be used.
 4. Medical examination results of all employees (OSHA 1910.1001), including chest roentgenogram, pulmonary function and forced expiratory volume at one second (Contractor is responsible for obtaining the appropriate medical releases).
 5. Schedule for changing filters in negative air pressure system and water filtration system.
 6. Copies of all OSHA Form 101 or equivalent accident/injury/incident reports.

- D. The Contractor shall submit directly to the WCSD, ES&A Department, **not Capital Projects Construction personnel**, or the Districts Consultant, upon each jobs completion And prior to final invoice submittal, a complete original documents job package including the following, **this is in addition to any other contract required documentation or documentation requested by others like asbestos consultants:**
1. Asbestos Removal Certification Letter signed and dated by the Contractors representative with language certifying that all asbestos materials have been properly removed in accordance with all Federal, State and Local regulations.
 2. Asbestos insurance certificates
 3. Manometer documentation that records air pressure differential between work areas and external air).
 3. Copies of all daily manpower, work logs, and containment sign in logs indicating area(s) and type of work performed.
 4. An original copy of all certifications of disposal.
 5. Copies of permits.
 6. Copy of the submitted notifications or courtesy notifications
 7. Personal air sampling logs and an original air sampling results of each personal air sample taken on the project. The submitted log and sample results must include all the required data listed under air monitoring, Section 02120, part 2 of the technical specifications on page 23 and 24. The submittal of all personal sampling data identified above is in addition to the submittal of daily sample logs.
- E. It is the Districts intention that the Contractors are responsible for supplying to the WCSD ES&A Department all Contractor generated documents. WCSD District-hired asbestos abatement consultants will be required to supply the following documents as a minimum, to the WCSD ES&A Department, at the end of the project and prior to final billing. The cost for development and submittal of the following is to be included in the asbestos consulting cost estimates provided to WCSD. Any costs for asbestos consultants to gather and/or submit a duplications of Contractor items listed above is not to be added to the Consultant's cost estimate. The District will not pay for this service twice, as the document submission of Contractor documents will be included in a Contractor's bid.
1. Summary letter explaining what was done, with a certification statement that observed work was done in accordance with Contract Specifications.
 2. Drawing identifying what was done with post abatement notes, with information as required to identify all abatement work done.
 3. Consultant's Daily logs documenting what was done, notes and narratives of the daily progress of the Contractor, and the steps taken to enforce contract specifications. Important project milestones should be addressed, as well in these daily logs, and pictures are encouraged.

4. Clearance air sampling maps identifying the outline of the abatement containment, date that the samples were taken, times that pumps were turned on and off, and flow measurements for each set of clearance air samples.
 5. Copy of each clearance air sample laboratory chain of custody forms.
 6. A copy of each clearance air sample laboratory results.
 7. Area air sampling maps identifying the location samples were taken, date that the samples were taken, times that pumps were turned on and off, and flow measurements for each set of area air samples.
 8. Copy of each area air sample laboratory chain of custody forms.
 9. A copy of each area air sample laboratory results.
 10. Bulk sampling map(s) identifying the locations any bulk samples were taken (if applicable).
 11. Copy of any bulk sample laboratory chain of custody forms (if applicable).
 12. A copy of each bulk sample laboratory results (if applicable).
- F. The Contractor will submit daily by fax or e-mail to the WCSD, ES&A Department a copy of a daily air monitoring log with the numbers of all air monitoring cassette taken that day and the location taken or activity conducted by the personnel wearing the sample. A copy of each projects sample logs will not be acceptable. The daily sampling data listed above must be combined from all projects and listed on one daily air-monitoring log.
- G. The Contractor shall have his laboratory e-mail or fax within **48 hours** of the date the sample was taken final laboratory result documents for air monitoring to the WCSD, ES&A Department. No hand written result report will be allowed. The laboratory reports will reference the air monitoring cassette's factory assigned number and the personal air monitoring results must be properly applied to an 8 hour time weighted average. Failure to submit results within the required 72 hour period may result in the District temporarily stopping the applicable abatement projects until results are received. Continued failure may also result in the termination of this contract.
- H. The contractor may only invoice for a percentage of the project as agreed upon by the WCSD Project Manager & Contractor at the completion of work. but prior to submitting the final complete job package to the WCSD, ES&A Department at the Contrator discretion. The remaining agreed upon % may not be invoiced, and will not be authorized for payment until a complete job package has been submitted to the WCSD, ES&A Department and the completed package has been reviewed for correctness and accepted and all restoration of damage has been completed.

- I. The Contractor will submit **daily** by fax or e-mail to the WCSD, ES&A Department an activity log with the location that contractor conducted activities that day, with a complete listing of workers assigned to each project.
- J. Upon submittal, job packages will be reviewed for completeness by the WCSD, ES&A Department. In the event that a job package must be returned more than once, due to omissions or corrections, the contractor shall deduct a \$200.00 processing fee from the projects final invoice, one fee per each occurrence after the first that the WCSD ES&A Department, district consultant or WCSD project Manager must contact the contractor due to omissions or errors.

PART 4 - SPECIAL PROCEDURES

4.01 ACCEPTANCE CRITERIA

- A. Before any building or section of any building can be occupied by any personnel without respiratory protection, the level of airborne fibers must be less than or equal to the AHERA clearance level.
- B. After the final cleaning, projects will be cleared by laboratory analysis of 5 air monitoring cassettes taken by the Owner, or Owner representative, inside the containment using aggressive methods. The analysis of cassettes from projects under 160 square feet will be analyzed by Phase Contrast Microscopy (PCM), NIOSH 7400. Projects over 160 square feet will analyzed by Transmission Electron Microscopy (TEM). Acceptable clearance levels for PCM analysis is all samples must be less than or equal to .01 fibers/cc. The Acceptable clearance level for TEM analysis is the average of the 5 samples taken inside the containment must be equal to or less than 70 asbestos structures per square millimeter. Fiber levels outside of the containment **cannot** be deducted from samples inside the containment to meet clearance criteria. It is the Contractor's responsibility to filter make-up air if so deemed necessary. Failure to filter a containments make up air will not relieve the Contractor from reimbursing the District for additional clearance samples that exceed clearance levels and fibers from outside the containment are suspected.
- C. In the event that the initial clearance samples do not meet with the above protocol for air sampling clearance, the Contractor shall bear all costs required to perform additional sampling.
- D. The District or Districts hired asbestos consultant will only perform as many air clearances as time allows. All attempts will be made to accommodate all requested requests for air clearance but the Contractor will be required to anticipate this requirement. Any delays or equipment tie ups due to the Contractors requiring more clearance samples then time allows on any given District work day is solely the responsibility of the Contractors and no additional fees will be paid to the contractor by the District. The Contractor will be required to have enough equipment available to maintain the required schedule in spite of any delays due the contractor requiring more samples then time allows. Locations requiring clearance sampling must be scheduled with the District one (1) day in advance by mail or fax. The containment must be ready for clearance sampling by 12:00 PM or earlier the day the samples are scheduled to be taken or the samples will be taken the next day. Contractor will anticipate an up to a 48 hour delay in receiving from the District TEM laboratory results.

4.02 STOPPING THE WORK

- A. If, at any time, the WCSD, ES&A Department decides that work practices are violating pertinent provisions of the Contract, endangering workers, innocent bystanders, or endangering District facilities, they will immediately notify the Contractor in writing that operations shall cease until corrective action is taken and the Contractor shall take such corrective action before proceeding with the work.
- B. If, at any time, the negative air pressure system is not operating in compliance with Sections 02120, PART 3, 3.02 and 02140, PART 1, 1.01H, and/or units are non-operational, operations shall cease until corrective action is taken and the Contractor shall take such corrective action before proceeding with the work.
- C. Delays caused by inappropriate work practices as noted in 4.02A or 4.02B (Section 02110, PART 4) and/or excessive airborne fiber concentrations (defined as concentrations in excess of 0.2 fibers/cc, TWA) shall be at the Contractor's expense. No later claims for extra compensation which result from action taken under 4.02A, 4.02B or 4.02C (Section 02110, PART 4), or other delays caused by the Contractor failure to comply this Contract specifications will be recognized by the District.
- D. In case of disagreement between the District and the Contractor regarding the analysis of any air monitoring data, either personal or area, the results of the District will be regarded as final and conclusive.

4.03 SITE SECURITY

- A. The work area is to be restricted only to authorized, trained, and protected personnel. These may include the Contractor's employees, employees of subcontractors, District employees and representatives, State and local inspectors and any other designated individuals. The Contractor is responsible to ensure that the security of the building is not diminished and install all outside negative air machine exhaust ports in a secure manner. Failure to provide adequate security measures will leave the Contractor responsible to loss or damage of property if it is determined that access was gained through an inadequate security measure employed by the Contractor. A list of authorized personnel shall be established prior to job start and posted in the clean room of the worker decontamination facility and in the Contractor's office. The Contractor will not restrict access to District asbestos personnel to any asbestos containment at any time.
 - 1. Contractor shall be notified by the District of any other authorized visitors prior to their entry to the job site.
- B. Entry into the work area by unauthorized individuals shall be reported immediately to the District by the Contractor.

- C. A log sheet shall be maintained in the clean-room area of the worker decontamination system or Contractor's office. Anyone who enters the work area must record name, affiliation, time in, and time out for each entry (See Section 02140, PART 1, 1.04G).
- D. Should any keys that have been signed out to the Contractor become lost and cannot be found, the Contractor may be responsible for all cost associated with re-keying all locks at the site that the lost key opened.

4.04 EMERGENCY PLANNING

- A. Emergency planning and procedures shall be developed by the Contractor prior to abatement initiation and agreed to by the Contractor and District.
- B. Emergency procedures shall be in written form and prominently posted in the clean change area and equipment room of the worker decontamination area. All employees must read and sign these procedures to acknowledge receipt and understanding of work site layout, location of emergency exits and emergency procedures.
- C. Emergencies may arise during the progress of work which may require special effort or require extra shifts of personnel to continue the work beyond the normal working hours. Be prepared in case of such emergency to do all necessary work promptly, at no additional cost to the District.
- D. The Contractor shall file with District the names, addresses and telephone numbers of local personnel who can be contacted at any time in case of emergency. These persons must be fully authorized and equipped to correct unsafe conditions on short notice.
- E. The Contractor shall provide the District with means to contact the Contractor or his representative, available 24 hours a day, in the case of emergencies while asbestos projects are in progress. Acceptable means would be a home or office phone plus a cell phone or beeper for when the Contractor is out of the home or office. Vehicle phone will not be acceptable. If the Contractor assigns this responsibility to one of his employees, the employee must have authorization and the ability to perform any emergency response requested.

4.05 PRE-CONSTRUCTION MEETING

- A. The Contractor shall attend as specified a pre-construction job meeting at a time agreed upon by the Contractor and the District. Attending this meeting will be representatives of the District who will actually participate in the District's asbestos project monitoring program. The preconstruction meeting may be held via the telephone at the District's option. This meeting may be waived at the District's discretion.
- B. At this meeting or prior to starting work, the Contractor shall provide all submittals as required in Section 02110, PART 3. They shall be prepared to discuss the following information:

1. Preparation of work area.
2. Personal protective equipment including respiratory protection and protective clothing.
3. Employees who will participate in the project, including delineation of experience, training, and assigned responsibilities during the project.
4. Decontamination procedures for personnel, work area and equipment.
5. Abatement methods and procedures to be utilized.
6. Required air monitoring procedures.
7. Procedures for handling and disposing of waste materials.
8. Procedures for final decontamination and clean-up.
9. Detailed work and performance schedule.
10. Emergency procedures.

SECTION 02120

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

- 1.01 It should not be inferred that all materials, tools and equipment listed in Part 2 are required or that all required materials, tools and equipment necessary are listed herein.

PART 2 - MATERIALS

- 2.01 Deliver all materials in the original packages, containers or bundles bearing the name of the manufacturer, the brand name, and labeling as required by 29 CFR 1910.1200.
- A. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
 - B. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Material that becomes contaminated with asbestos shall be disposed of in accordance with the applicable regulations.
- 2.02 Polyethylene sheeting of a **true** 4 mil and 6 mil thickness unless otherwise specified, clear in color and in sizes to minimize the frequency of joints. All Polyethylene sheeting will be **Fire retardant**.
- 2.03 Polyethylene bags, properly labeled, of a **true** 6 mil thickness, clear in color, for disposal of asbestos debris.
- 2.04 Tape - capable of sealing joints of adjacent sheets of plastic sheets and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under dry and wet conditions, including use of amended water, chemical removers, or removal encapsulant.
- 2.05 Surfactant (wetting agent) - shall consist of 50% polyoxyethylene ester and 50% polyoxyethylene ether, or equivalent and shall be mixed with water to provide a concentration of 1.25 kg/cubic meter of water.
- 2.06 Chemical Remover - suitable to aid in removal of ACM such as EPA 55 or equivalent.
- 2.07 Removal Encapsulant - suitable to aid in removal of ACM such as Asbestite 1000, Serpiflex Shield #4, BWE 5000, or equivalent; the removal encapsulant shall act as its own solvent and be capable of binding and encapsulating individual asbestos fibers.
- 2.08 Impermeable containers (Drums) - suitable to receive and retain any asbestos-containing or contaminated materials until disposal at an approved site. (The containers shall be labeled in accordance with OSHA Regulations 29 CFR 1910.1001).

- 2.09 Warning labels and signs - as required by Regulation.
- 2.10 Encapsulant - Penetrating type, such as Asbestite 2000, American Coatings' Cable Coating 22p, SK 13-1C, BWE 3000, or equivalent. The encapsulant should have a coverage of 80 square feet per gallon and shall be compatible with new applications of flooring mastic. The encapsulant **must** be **clear** in color.
- 2.11 Encapsulant - Bridging type, such as American Coating FNE High Temperature Sealant, Ocean 666, or equivalent. Bridging encapsulant shall have a coverage of 25 square feet per gallon. Any encapsulant installed must be compatible with any new products that will be installed over the encapsulated such as flooring products.
- 2.12 Spray Poly - Spray applied water resistant film with minimum coverage of 16 mil thickness when wet, such as Isotek Spray Poly or equivalent.
- 2.13 Other Materials - provide all other materials as specified in drawings; also, other materials such as lumber, nails, and hardware, which may be required to construct and dismantle the decontamination area and the barriers that isolate the work area.
- 2.14 Chemical Mastic Remover - A non-flammable solvent manufactured especially for the removal of mastic materials such as Control Low Odor, Sentinel 747, or equivalent. The flash point shall be no less than 140 degrees Fahrenheit.

PART 3 - TOOLS AND EQUIPMENT

- 3.01 Provide suitable tools for asbestos removal. The minimum acceptable amount of equipment to support this contract is estimated at 4 recording manometers, 4 standard incline manometers, 4 shower and water filter units, and twenty four 1500 cfm negative air units. This is an estimate of the minimum equipment and additional equipment may be required to comply with Contract Specifications and Documents.
 - A. If the Contractor is unable to keep up with the requested work schedule due to the lack of required equipment or inoperable equipment, the District reserves the right to purchase or rent equipment which will then be supplied to the Contractor. The Contractor will then be responsible to reimburse the District for the cost associated with the rental or procurement. The District would only exercise this option in the event the Contractor fails to take reasonable steps on his own to repair his own equipment or rent or procure equipment necessary to keep up with the requested schedule.
 - B. Under no circumstance will contaminated tools or equipment, be placed inside of a District room outside of a containment. Contaminated tools and equipment will be sealed in impermeable plastic bags (minimum of six-mil thick) and **immediately** transported into the containment from the transporting vehicle directly into a containment that has already had its critical barriers completed and is under negative pressure. This includes equipment or tools that is placed in bags or sealed in plastic.

- 3.02 Negative Air Pressure System - a negative pressure must be established in the work area by means of a local exhaust system. The equipment shall exhaust through a **three** or more stage HEPA filtration system to the outside of the work area. The equipment shall be in operation for 24 hours per day until decontamination and final clean-up of the work area is completed. A recording device shall be used to provide documentation of the pressure differential of 0.03 inches of water gauge. The system shall have the following additional characteristics:
- A. Filtration equipment in compliance with ANSI Z9.2, Local Exhaust Ventilation.
 - B. Capable of maintaining a minimum pressure differential of minus 0.05 inch of water gauge in the work area relative to adjacent areas. The 0.05 inch of water gauge requirement must be maintained throughout the removal process including the waste load out and during the entrance and exit of the containment through the Decon. It is suggested that this is considered when calculating the negative air requirements of each containment.
 - C. Negative air pressure system units shall be employed in sufficient quantity to provide no less than **eight (8)** air changes per hour in the work area.
 - D. Negative pressure units **must** be exhausted to the outside of the building through a reinforced **Owner** approved opening. In the event a window or door to the outside is removed, the opening installed will be vandal proof and not reduce the security of the building. As a minimum, when a window or door is removed, the contractor must install a plug constructed of 1/2" plywood. The plug must be larger than the hole and secured inside the opening with two or more wood 2 x 4s installed crosswise and secured with 3/8" tamper proof bolts.
 - E. **Pre-fabricated** metal reinforced exhaust tube will be utilized to exhaust all negative air machines. The exhaust tubing utilized must be the same size throughout the exhaust run and the same size as the negative air machine exhaust port. Continuous runs of tubing without splices are required for runs less than twenty-five feet (25'). The Pre-fabricated exhaust tubes will be replaced at the first signs of wear. Contaminated, taped or damaged tubes will not be allowed to be used. The Districts decision regarding when an exhaust tube requires replacement will be regarded as final and conclusive.
 - F. At the discretion of the Owner and at no extra cost the contractor may be required to install an extension to the negative air exhaust tube where it exits a containment. The extension will be constructed of metal reinforced exhaust tubing. Typically the extension would extend from the plug to a point on the roof determined by the District inspector.

- G. The negative air machine exhaust tubing will be routed as per the direction of the District inspector. The routing of the negative air machine exhaust tubing through rooms not included in the containment will not be allowed unless there are no exterior windows or doors present inside the containment area. In the case of inoperable windows, Contractors will be required to hire a window company or perform the work themselves to remove and properly re-install inoperable windows as required so the negative air machine exhaust tubing is routed through windows. Only the WCSO ES&A department AHERA Project Designer certified staff are allowed to sign off on any instance, where a negative air machine tube is routed through a room that is not a part of the asbestos abatement containment area, instead of using a window or other exterior openings. No exceptions and Contractors must bid accordingly.
- 3.03 Water Filtration System - Water used for showering in the decontamination area and any other asbestos-contaminated water must be filtered prior to disposal as waste water. The system shall contain at a minimum a three-stage filtering system with the following additional characteristic:
 - A. Capable of trapping and retaining 99.9% of asbestos fibers greater than 3 microns in size.
 - B. All water systems equipment to include showers and filter systems will comply with all (including the District's) applicable backflow/cross connection prevention requirements. The District will enforce all backflow/cross connection prevention requirements
 - 3.04 Airless Pump - Encapsulant, if spray-applied, shall be applied with an airless pump in order to minimize fiber dispersion during the decontamination process. The tip shall have an orifice of .019 to .026 or as required by the manufacturer of the encapsulant selected for use.
 - 3.05 Type "C" Supplied Air System - A continuous flow or pressure-demand, supplied air respirator, NIOSH/MSHA certified or other suitable air filtration system, as required by OSHA regulations for performance of work of this nature, is suggested for all workers. Type "C" system shall have visual and audible alarms to warn of carbon monoxide levels in excess of 20 ppm. Such system shall meet all criteria prescribed by OSHA for supplied air respirators. It also must be fully certified for hose length combinations up to 300 feet. Either half-mask or full facepiece units fitted with HEPA filter back-up units are acceptable.
 - 3.06 Temporary electrical cords and outlets shall be of an approved type and connected to a source of power outside of the work area as directed by the District (see Section 02140, 1.01). All temp power cords must be plugged into a ground fault interrupter equipped power source.

SECTION 02130

COMPLIANCE REQUIREMENTS

PART 1 - PERSONAL PROTECTION

1.01 RESPIRATORY PROTECTION

- A. Provide workers with clean and properly maintained respiratory equipment approved by NIOSH/MSHA as specified in Section 02120, PART 3, 3.05. The Contractor must present documentation of no less than five (5) similar projects with personal sampling results indicating that employee exposure levels were at "clean air levels" (0.01 f/cc) inside the respirator. Half-mask air-purifying respirators equipped with high-efficiency particulate air (HEPA) filters may be utilized with written permission of the Owner. Initially, temporary approval for the use of half-mask respirators will be granted after receipt of the proof requested above. Continued authorization will be considered based thereafter on personal monitoring samples taken on projects completed under this contract. If the Contractor consistently maintains personal monitors levels at or below "clean air levels" (0.01 f/cc inside the respirator) on a 8 hour time weighted average, continued use of half-mask respirators will be authorized. Should the personal monitoring or area monitoring levels show the contractor is unable to maintain levels at the "clean air levels" (0.01 f/cc), inside the respirator, the half-mask authorization will be rescinded. Area or personnel monitoring level above 1.0 fibers/cc TWA will require that personnel utilize type "C" respiratory protection. The Contractor will be responsible for providing sample results that have been applied over the 8 hour time weighted average. When utilized, the Contractor shall provide a sufficient quantity of filters during the work day. The clean respirator filters shall be stored at the job site in the change room and shall be totally protected from exposure to asbestos prior to their use.site in the change room and shall be totally protected from exposure to asbestos prior to their use.
1. Single-use or disposable respirators will not be permitted at the job site.
 2. Contractor shall also monitor and provide documentation indicating that the workers are properly protected against over exposure to any of the chemicals contained in the chemical mastic remover(s).
 3. Additional air filter protection will be required when chemical solvents are used.

1.02 PROTECTIVE CLOTHING

- A. Provide workers with sufficient sets of protective full-body clothing. Such clothing shall consist of full-body coveralls and headgear. Provide eye protection and hard hats as required by applicable safety regulations. Non-disposable type protective clothing and footwear shall be left

in the Contaminated Equipment Room until the end of the asbestos abatement work, at which time such items shall be disposed of as asbestos waste, or shall be thoroughly cleaned of all asbestos or asbestos-containing material. Disposable type protective clothing, headgear, and footwear may be used and shall be disposed of as asbestos waste. Bare feet will not be permitted.

1.03 WORKER PROTECTION PROCEDURES

- A. Each worker shall, upon entering the job site: Remove street clothes in the clean change room, put on a respirator and clean protective clothing before entering the equipment room or work area, except that workers intending to rewear contaminated protective clothing stored in the equipment room shall enter equipment room wearing respirators.
- B. Each worker shall, each time he leaves the work area: Remove gross contamination from clothing before leaving the work area; proceed to the equipment room and remove all clothing except respirators; still wearing the respirator, proceed to the showers; clean the outside of the respirator with soap and water while showering; remove the respirator; thoroughly shampoo and wash themselves, remove filters (where required) and place them in the container provided for the purpose; and wash and rinse the inside of the respirator.
- C. Following showering, each worker shall proceed directly to the clean change room and dress in clean clothes at the end of each day's work, or before eating, smoking or drinking. Before re-entering the work area from the clean change room, each worker and authorized visitor shall put on a clean respirator with filters (where required) and shall dress in clean protective clothing, except that workers intending to rewear contaminated protective clothing stored in the equipment room shall enter the equipment room wearing respirators.
- D. Contaminated work footwear shall be stored in the equipment room when not in use in the work area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from equipment and access area. Store contaminated protective clothing in the equipment room for reuse or place in receptacles for disposal with other asbestos contaminated materials.
- E. Workers shall not eat, drink, smoke or chew gum or tobacco, or utilize sanitary (toilet) facilities at the worksite except in established locations outside the work and containment areas, and enclosures.
- F. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbances of asbestos-containing or contaminated materials and until final clean-up is completed. This includes removal of fixtures, ceilings, or anything else which may disturb the ACM.

PART 2 - AIR MONITORING

- 2.01 Throughout the removal and subsequent cleaning operations AMBIENT (AREA) MONITORING may be conducted by the District to ensure that the Contractor is complying with all regulations and is conducting the work in a manner which minimizes airborne asbestos levels as well as minimizes the contamination of the District's facilities.
- A. The Contractor is responsible to complete all regulatory required area monitoring and all area monitoring that is required by the Contractors liability insurance company.
- 2.02 Throughout the removal and subsequent cleaning operations, PERSONAL AIR MONITORING shall be conducted by the Contractor. Such samples shall be taken in order to establish an 8-hour TWA (for example, a minimum time of 480 minutes at 2.0 lpm) and exposure for each type of employee operation. Analytical results of personal air samples shall be sent to the Districts ES&A Department and provided to the Districts asbestos consultant on a 72 hour turn-around basis. Electronic PDF final reports shall be e-mailed directly to the District ES&A department directly from the Contractor's laboratory. Personal monitoring will be conducted on 50% of the workers. The workers shall wear personal monitoring devices, and all sampling will be conducted in each workers breathing zone only. Asbestos Consultants hired by WCSD, and supervising asbestos abatement projects, are required to strictly enforce these Personal Air Monitoring requirements, so Contractors must plan accordingly. Failure for the Contractor to provide air sampling results within 72 hours requires that the District's consultant supervising the project must stop the job. No exceptions. To that end, District Consultants must monitor the situation and provide the Contractor a written 24 hours notification, after 48 hours that results have not been received. After these 24 hours have transpired, the Consultant must stop the job awaiting submittal of required sampling results. No exceptions.
- A. For each set of air samples submitted to a laboratory by the Contractor for analysis, the Contractor shall submit a blank cassette for analysis (minimum of 10 percent). Each blank cassette shall be submitted as a part of the Contractor's quality control program.
- B. Any PCM air sample submitted by the Contractor for analysis shall be to an independent laboratory currently enrolled in the AIHA/NIOSH proficiency Analytical Testing (PAT) program.
- C. The Contractor shall use factory pre-numbered air monitoring cassettes and note each cassette's numbers on the daily log or a separate monitoring cassette log. The number on each cassette shall be recorded **PRIOR** to use. Each cassette's number will also be listed on the laboratory analysis request form and also be referenced on the Laboratory sample analysis report. A copy of the daily log or separate monitoring cassette log will be e-mailed to the ES&A department **and** the District's asbestos consultant **daily** for all projects in progress. Asbestos Consultants hired by WCSD and supervising asbestos abatement projects are required to strictly enforce these requirements so they must monitor and document this process as a part of the Consultants project monitoring process.

- D. Daily project personal air sample logs must be kept and submitted. As a minimum the sample log must include, date sample taken, air flow measurements taken at the start and finish of the sampling duration, time started and stopped, the factory assigned cassette number, employee sampled, and the activity of the employee. Legible sample logs will be submitted in the completed job package along with an original laboratory analysis report. Consultants hired by WCSD and supervising asbestos abatement projects are required to strictly enforce these requirements so they must monitor and document this process as a part of the Consultants project monitoring process.
- E. A credit of \$25.00 per sample will be deducted from the Contractors final invoice for each documented case, that a required sample per contract specifications (50% of the workforce is NOT monitored) was not taken or submitted for analysis. In addition, this credit will also apply to samples that were not taken properly or the data required by contract specifications is not provided. Consultants hired by WCSD and supervising asbestos abatement projects are required to strictly enforce these requirements so they must monitor and document this process as a part of the Consultants project monitoring process.

PART 3 - SUPPORT ACTIVITIES AND PERSONNEL

3.01 TRAINING

- A. Training by a EPA accredited training provider shall be provided by the Contractor to **all** employees or agents or subcontractors who may be required to disturb asbestos-containing or asbestos-contaminated materials for abatement and auxiliary purposes and to all Contractor supervisory personnel who may be involved in planning, execution, or inspection of abatement projects. **No on-line training certificates for Lead or Asbestos training will be accepted.**
- B. Training shall provide, at a minimum, information on the following topics:
 - 1. The health hazards of asbestos including the nature of various asbestos related diseases, routes or exposure, known dose-response relationships, the synergistic relationship between asbestos exposure and cigarette smoking, latency periods for disease and health basis for standards.
 - 2. The physical characteristics of asbestos including fiber size, aerodynamic properties, physical appearance and uses.
 - 3. Employee personal protective equipment including the types and characteristics of respirator classes, limitations of respirators, proper selection, inspection, donning, use, maintenance and storage of respirators, field testing the facepiece-to-face seal (positive and negative pressure fitting tests), qualitative and quantitative fit testing procedures,

variations between laboratory and field fit factors, factors that affect respirator fit (e.g., facial hair), selection and use of disposable clothing, non-skid shoes, gloves, eye protection, and hard hats.

4. Medical monitoring requirements for workers including required and recommended tests, reasons for medical monitoring, and employee access to records.
 5. Air monitoring procedures and requirements for workers including description of equipment and procedures, reasons for monitoring, types of samples, and current standards with recommended changes.
 6. Work practices for asbestos abatement including purpose, proper construction and maintenance of plastic barriers, job set-up of airlocks, worker decontamination systems and waste transfer airlocks, posting of warning signs, engineering controls, electrical and ventilation system lockout, proper working techniques, waste cleanup, and storage and disposal procedures.
 7. Personal hygiene including entry and exit procedures for the work area, use of showers and prohibition of eating, drinking, smoking, and chewing in the work area.
 8. Special safety hazards that may be encountered including electrical hazards, air contaminants (CO, wetting agents, encapsulant, materials from Owner's operation), fire and explosion hazards, scaffold and ladder hazards, slippery surfaces, confined spaces, heat stress, and noise.
 9. Workshops affording both supervisory personnel and abatement workers the opportunity to see (and experience) the construction of containment barriers and decontamination facilities.
- C. Training is to have occurred within 12 months prior to the initiation of abatement activities.
- D. Contractor must document training by providing date(s) of training, training entity, course outline, and names and qualifications of trainers.
- E. Submit documentation to the District indicating that all employees have taken the required AHERA training for the type of work they will be performing per Section 02110, Part 3, 3.01, B, of these specifications.
- F. An employee of the Contractor or subcontractor who is deemed incompetent, disorderly, or otherwise objectionable by the Owner, shall be removed promptly by the Contractor, and not re-employed on the work. Any employee of the Contractor that is observed that is not utilizing his personal protective equipment will be immediately removed from a project and not allowed on any other District projects. Should any disagreements result regarding the identification of the employee or his/her proper use of personal protective equipment, the determination of the District AHERA Program Supervisor/ Technicians or District hired Consultant will be considered final and

conclusive. The Contractors Asbestos Abatement Supervisors who allow employees to not utilize their personal protective equipment will be immediately removed from a project and not allowed on any other District projects. Contractors will be required to replace removed employees/Supervisors and no additional time will be allowed to complete the project.

PART 4 - MEDICAL MONITORING

- A. Medical monitoring must be provided by the Contractor to any employee or agent that may be exposed to asbestos in excess of background levels during any phase of the abatement project. The purposes of a medical monitoring program, in addition to meeting the requirements of the law, are to document the state of health of workers for workers' compensation and to determine work relatedness of disease as well as to ensure fitness for duty, particularly ability to wear a respirator. Smokers should be made aware of the synergistic effects of cigarette smoking and asbestos exposure. The medical monitoring program provides the appropriate setting to share this information. Employers should also be aware of the potential cost of this additional risk. Medical monitoring shall include at a minimum the requirements of OSHA 29 CFR 1910.1001 (1).
1. A work/medical history to elicit symptomatology of respiratory disease (see CFR 1910.1001), Appendix D, Medical Questionnaires).
 2. A chest X-ray (posterior-anterior, 14 x 17 inches) taken by a certified radiology technician and evaluated by a certified B-reader.
 3. A pulmonary function test, including forced vital capacity (FVC) and forced expiratory volume at one second (FEV.), and FEV/FVC ratio (administered by a NIOSH or A.T.S. Certified Pulmonary Technician and interpreted and compared to standardized normals by a Board Certified Occupational Physician or Pulmonary Specialist).
 4. Employees shall be given the opportunity to be evaluated by a physician to determine their capability to work safely while breathing through the added resistance of a respirator. (Examining physicians shall be aware of the nature of respiratory protective devices and their contributions to breathing resistance. They shall also be informed of the specific types of respirators the employees shall be required to wear and the work they will be required to perform, as well as special workplace conditions such as high temperatures, high humidity, and chemical contaminants to which they may be exposed. Evaluation of groups of workers should take into consideration epidemiologic principals as suggested by the American Thoracic Society in their statement on the work relatedness of disease adopted in 1982).

SECTION 02140

EXECUTION

PART 1 - PREPARATION

1.01 WORK AREA;

- A. The following procedures are to be utilized to establish a work area and containments for all projects except mini work areas and mini-containments;
1. Shut down electrical power as necessary. When and where required, provide temporary power and lighting and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements and provide safety lighting and ground fault interrupter circuits as power source for electrical equipment.
 2. Shut down and isolate heating, cooling, ventilating air systems to prevent contamination and fiber dispersal to other areas of the structure. During the work, vents or openings within the work area shall be sealed with tape and at least 2 layers of 6 mil poly sheeting.
 3. As directed by the District, pre-clean fixed objects within the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods, and enclose all fixed objects with a minimum of clear 6 mil plastic sheeting sealed with tape. This is in addition to the splash protection layer specified in item F below. All edges of the 6 mil will sealed with duct tape.
 4. As directed by the District, pre-clean the proposed work areas using HEPA-filtered vacuum equipment and wet cleaning methods. Methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters shall not be used. Failure to pre-clean may increase the nuisance fiber level inside the containment and thereby raise personal monitoring results.
 5. Seal off all openings with critical barriers, including, but not limited to, windows, corridors, doorways, skylights, duct, grille, or diffuser openings and any other penetrations of the work areas, with clear 6 mil plastic sheeting sealed with tape. Doorways, windows and corridors which will not be used for passage during work must be sealed with two layers of 6 mil plastic barriers. Doors and windows can be taped around the edges and then covered with one layer of clear 6 mil plastic to achieve the two layer requirement. Any opening that requires support such as hallways or large opening or other large criticals must be supported with 2x4 studs, 24 inches on center
 6. All doors will be left in place unless approved by the ES&A Director. Doors are much more secure than plastic critical which is why these will not allowed to be removed. If there is tile/mastic under the door in the door opening the following is the only procedure that will be allowed. The contractor shall create the entire containment except for sealing the doors that have tile under them. The containment and negative air will be in place and running and the containment, other than the doors will have been inspected and

approved. Once this has happened, the contractor shall have a worker don proper personal protective equipment (PPE) and then do a spot abatement in the area under the door using manual methods. The worker shall complete spot abatement under the door and the door will be secured and sealed per #5 above. No abatement shall take place inside the containment, other than doorway spot abatement. The number of doorways that can be spot abated at one time will be no more than two at a time.

7. If the Contractor is removing asbestos containing materials, and the flooring material within the containment is not identified for abatement, cover floor surfaces with at least 2 layers of 6 mil poly. Use a minimum of two layers of clear 6 mil poly. Cover the floor **first** so that the 2 layers of plastic that extends at least 12 inches up on the walls. Depending on the material of the roof and its practicality of being wet wiped the Owner may require that one clear layer of 4 or 6 mil plastic layer be installed for a ceiling.
8. Cover wall surfaces with plastic sheeting sealed with tape. Use a minimum of one (1) clear layer of 4 mil plastic on walls. Cover walls so that the plastic extends eight (8) feet above the area of work. Seams should overlap a minimum of six (6) inches.
9. Build airlocks at entrances to and exits from the work area. Airlocks should be built in a manner which allows for in-flow air. The installation of air locks which restrict the air flow of make-up air through the Decon will not be permitted. Additional make-up air, if required to achieve eight (8) air changes, shall be admitted through specially constructed vents which prevent contaminated air from leaving the work area.
10. Contractor may be required to install one clear layer of 4 or 6 mil plastic layer for a ceiling in the containment depending upon the ceilings construction, asbestos design considerations, and its air permeability and the ability to maintain negative pressure inside the containment.
11. Establish negative air pressure system which produces no less than eight (8) air changes per hour in the work area and maintains a pressure differential of 0.05 inch water gauge between the inside and outside of the work area. The location and identification of each individual negative air unit shall be provided to the District for each work area. The District, as certified Project managers reserves the right to direct the contractor to relocate the negative air machines. Identification (for example, labels) shall be clearly visible in the work area and at the unit's exhaust location.
12. The Contractor shall provide two manometers, located as directed by the Owner. The first manometer shall be a continuous printout type with an adjustable set-point audible alarm. The alarm may not be deactivated. The second shall be a standard inclined manometer, Dwyer Model 250.5 AF or approved equal.
13. As directed by the District, remove and clean ceiling or wall mounted objects, such as lights and other items not previously sealed off, that interferes with asbestos abatement. Use localized water spraying or HEPA filtered vacuum equipment during fixture removal to reduce the fiber dispersal.

14. Maintain emergency and fire exits from the work areas, or establish adequately marked alternative exits satisfactory to the District. The contractor will have on site before the start of the project a fire extinguisher and first aid kit.
 15. The Contractor shall place a job board with all MSDS, emergency numbers (24 Hour), safety procedures, air monitoring results, etc., at an accessible location to employees and visitors. The job board may be placed in the clean room overnight if the entrance to a containment is outside and the board's security is in question.
 16. Contractor shall provide a clear 18" x 18" plexi-glass view windows at locations designated by the Owner. Contractor will add or move viewing windows at any time throughout the project at the Owners request. View windows will never be covered once installed.
 17. Use smoke methods to test effectiveness of barriers and the negative pressure system when directed by the District.
- B. The following procedures shall be utilized to establish a work area and mini-containment for small scale/short duration projects. The Owner shall determine if a mini-containment is more practical or cost affective then the containment of the entire room space;
1. Prior to the construction of the mini-containment enclosure, the Contractor will consult with the Owner and receive Owner approval of the containments proposed design prior to the start of a mini-containment enclosure.
 2. Contractor shall construct a 2 layer, clear 6 mil poly enclosure with walls, a roof and a floor. The containment will be supported by means of wooden studs, PVC pipe, or other rigid materials. It will be sufficiently supported to ensure that negative pressure will not damage the containment. It will be large enough to ensure the material can be removed without puncturing the containment.
 3. Negative pressure inside the mini-containment will be provided by a small adjustable flow negative air machine. All mini-containments will require negative pressure and a HEPA vacuum cleaner will not be allowed to provide negative pressure except in very small mini-containments and only with prior written approval of the Owner.
 4. A two cell decontamination enclosure shall be installed to provide access to the containment and serve as a decontamination enclosure. Air-locks shall be installed at the entrance to the decontamination cell and the abatement containment. Minimum size of the decontamination enclosure shall be six feet high by 5 feet wide.
 5. Waste load-out and double bagging will be accomplished in the decontamination enclosure.

6. All other provisions of these contract documents and specifications apply to mini-containment enclosures except for the modification to the work area, decontamination enclosure and waste load-out addressed in 1 thru 4 above.
- C. The following procedures shall be utilized to establish a work area and perform abatement for windows and window sealant abatement. The following window procedure will be utilized to remove the window frame with possible asbestos containing putty, and asbestos containing window sealant (Caulking) from WCSD window openings.
1. From the inside of the school, inside of each classroom install Plywood ½” over the window opening. Install 2 layers of 6-mil polyethylene plastic (poly) on the exterior surface of the plywood, to assist with clean up of the plywood surface prior to installation of the plywood. After the plywood is installed, install 2 layers of 6 mil poly over the interior surface extending out past the edge of the plywood, and attach with tape in an adequate fashion to completely seal off the exterior window opening from the inside of the building. The removal cannot proceed until an airtight poly seal has been created between the inside and the outside of the window opening. This contractor will not be able to proceed with any removal until District’s ES&A personnel or District’s asbestos consultant approves the prep of each window. This will be documented in the contractor’s daily log and initialed by the District’s ES&A personnel or the District’s asbestos consultant.
 2. Washoe County Health Department personnel can be expected to visit the abatement site. The contractor will be required to cooperate and comply with all WCHD requests.
 3. Isolate the HVAC for the entire wing or area being abated, prior to the start of abatement.
 4. It may be necessary to isolate the wings adjacent to the building being abated, based upon the discretion of the District’s ES&A personnel or assigned asbestos consultant.
 5. Install 6-mil poly drop that extends out at least 20’ out and adjacent from each window opening. If any window debris leaves the poly drop area, the contractor will be required to HEPA vacuum the ground as directed by the District’s ES&A personnel or the District’s asbestos consultant.
 6. Place safety tape to isolate the area of the broken window from the public. At least 50 ‘ has to be isolated. Contractor will need to ensure that only abatement workers or the District’s ES&A personnel or the District’s asbestos consultant enter this area during abatement. No personnel or school staff will be allowed to work on the same side of the school wing when abatement activities are taking place. If a wing is directly across from the abatement activity that wings classrooms on the side of the abatement cannot be occupied.

7. As needed, use a glasscutter to score the inside of window glass to ease with glass removal. **A power tool cannot be used** for the removal of the window frame. Hand tool may be utilized.
8. As needed, remove glass by tapping on scored part of glass breaking it out, remove all glass present except the pieces behind putty. This makes it easier and safer to remove the frame without the glass being in the way.
9. Damage to and disturbance to the putty and sealant should be limited to the extent possible, and removed as intact as possible.
10. Pick up and dispose of the glass, asbestos debris and frame, in contractor's vehicle or dumpster for transport for proper asbestos disposal at a remote site. Do not dispose of debris in the District dumpster.
11. From the outside, clean up the internal area of the window frame, ledge and window jamb up to the poly window opening seal of any debris. The block opening will need to scraped, so that no sealant material is left behind before the window frame will pass a visual clearance, conducted by the District's ES&A personnel or the District's asbestos consultant. HEPA vacuum all areas of abatement surfaces, including the inside of the window opening prior to requesting a visual clearance.
12. When the window frame has been completely removed and the removal passes a visual clearance conducted by the District's ES&A personnel or District's asbestos consultant, carefully roll up the exterior poly drop that is on the ground, with the debris in it, and dispose at a remote location as asbestos waste. Do not dispose of any window poly/debris in the District dumpster.
13. Spray on encapsulate will be sprayed onto the window opening and poly surface of the plywood on the exterior side of the window opening.
14. Air Quality Air Samples may be taken once a wing is completed inside a number of the classrooms inside the wings by the District's ES&A personnel or the District's asbestos consultant and analyzed by TEM analysis. No personnel except the District's ES&A personnel or the District's asbestos consultant properly protected will be allowed inside the building being abated prior to receiving air sampling results or visual clearance. The plywood on the window openings will be left in place, and secured until air-sampling results or a visual clearance is received from the District's ES&A personnel or the District's asbestos consultant.
15. The window replacement contractor can work in the window opening, once the removal has passed a visual clearance, but cannot enter the area of demarcation or work on the same side of a building, while abatement is being conducted. Once abatement activities have been completed for the day, the replacement contractor could then work on that side of the building until abatement activities are resumed.

1.02 DECONTAMINATION ENCLOSURE SYSTEM AND WASTE LOAD-OUT AREA

A. Construct a worker decontamination enclosure system contiguous to the work area as follows:

1. The decontamination enclosure shall be constructed of two layers of 6 mil poly sealed with tape. At the discretion of the Owner the contractor may be required to construct a decontamination enclosure outside of the building. The exterior Decon shall be constructed with a minimum of 2x4 studs 24 inches on center and 1/2 inch plywood and to a standard which insures the security of the building. The outside chamber shall have a solid lockable door that shall remain locked whenever the Contractor is not on site. A key will be given to the Owner. The location of any decontamination enclosures will be determined by the Owner.
2. An equipment or dirty room with two doorways, one to the work area and one to the shower room. Pop-up Decon chambers typically will not be approved for use by the District. The use of Pop- up Decon Chambers will be reviewed on a case by case basis and the District reserves the right to require that they not be used.
3. A **metal** shower room with two doorways, one to the equipment room and one to the clean room. The shower room shall contain at least one shower with hot and cold water. Careful attention shall be paid to the shower enclosure to ensure against leaking of any kind. Ensure a supply of soap and shampoo at all times in the shower room. Clean and dry towels shall be available for employees and owner-authorized visitors and personnel. A three-stage water filtration system must be employed prior to release of shower water into the local sewage system. The shower must comply with all applicable backflow prevention/cross connection requirements including the Districts. Any shower or water device that does not meet the minimum air gap requirement will have to be fitted with the appropriate backflow prevention device. Proof of the required testing of any employed backflow prevention assembly will be required. Non-metal pop up showers are not acceptable.
4. A clean room with one doorway into the shower and one entrance or exit to non-contaminated areas of the building or outside. The clean room shall have sufficient space for storage of the workers' street clothes, towels and other non-contaminated items. Individual lockers shall be available to workers within the clean room. Pop-up Decon chambers typically will not be approved for use by the District. The use of Pop- up Decon Chambers will be reviewed on a case by case basis and the District reserves the right to require that they not be used.

B. As directed by the District, construct using (2) two layer of 6 mil. Poly, a waste load-out area contiguous to the work area which is utilized for transportation of ACM to a landfill.

1. The decontamination enclosure may only be used as a waste load out area with Owner approval, and only when it exits to the exterior of a building and there are no other exterior doors inside the containment. All waste load out activities will be accomplished through a waste load out enclosure exiting an exterior door whenever one is available.

The Decontamination enclosure will only be considered for use as a waste load out enclosure when all other avenues of exit are not deemed practical by the Owner.

1.03 MAINTENANCE OF ENCLOSURE SYSTEMS:

- A. Ensure that barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
- B. Visually inspect enclosures and negative air units at the beginning of each work period or shift. Details of the inspections are to be included in the Contractor's daily log. The contractor will be required to note the manometer readings of the containment in the daily log at the start and end of the shift and every 1/2 hour while on the job site. **The Contractor will be required to inspect containments at locations that are awaiting final clearance sampling results twice daily, once in the morning and once late in the afternoon before the building is scheduled to be locked up.**
- C. Use smoke methods to test effectiveness of barriers and the negative air pressure system when directed by the District.

1.04 ASBESTOS REMOVAL WORK SHALL NOT COMMENCE UNTIL;

- A. Arrangements have been made for disposal of waste at an acceptable site.
- B. Arrangements have been made for containing and/or disposal of waste water resulting from showering and other abatement activities.
- C. Work areas, decontamination enclosure system, and waste load-out area are effectively segregated.
- D. Tools, equipment and material waste receptacles are on-site.
- E. The Type "C" supplied air respirator system(s) or other approved air filtration system is (are) on-site and fully operative, when required by the District.
- F. All other preparatory steps have been taken and applicable notices posted and permits obtained.
- G. A visitor and employee log-in/log-out system is in place at the job site. All persons entering the site will be required to sign-in and sign-out.
- H. Plexi-glass view windows have been installed in all locations requested by the Owner.
- I. The containment has been inspected and written approval has been given by the Owner.

PART 2 - ASBESTOS REMOVAL

2.01 ORDER OF OPERATIONS

- A. In general, work shall progress in the following order of operations; this listing is not provided to suggest that abatement sequences or additional requirements may not be required of the Asbestos Abatement Contractor to comply with regulatory requirements depending on the specific nature of each particular asbestos abatement projects:
1. Site preparations (See Section 02140, PART 1).
 2. Removal of all asbestos debris and contaminated fixtures from the work site.
 4. Rough clean and remove all remaining asbestos debris.
 5. Detail clean and removal all asbestos containing asbestos debris and residual asbestos contaminants.
 4. Encapsulate all areas from which asbestos was removed. Any encapsulant installed must be compatible with any new products that will be installed over the encapsulation such as flooring products. Encapsulation will be done prior to taking air clearance samples or after air samples have been sampled to ensure that the project encapsulation activity complies with Nevada regulations. (See Section 02140, Part 2, 2.03)
 5. Clean up site (See Section 02140, PART 2, 2.04).
 6. Remove final (splash protection) layer of polyethylene sheeting from walls.
 7. Nothing in Section 02140, PART 2, 2.01 is meant to supersede the inspection procedures noted in Section 02150, PART 2.

2.02 REMOVAL PROCEDURES

- A. Floor covering may be removed physically, mechanically, or chemically. The work may include the abatement of asbestos containing material (ACM) on floors. New flooring materials will be installed over abatement areas so mastic removal techniques employed by the abatement contractor are to be done so that installed flooring products are able to be warranted by the flooring manufacturers. If the abatement contractor is being hired by a flooring contractor the abatement contractor must consult the flooring installer and ensure their employed removal techniques do not void any warranties for new installed products. It is quite possible that chemical mastic removers may not be able to be utilized to achieve this requirements. No power tools may be utilized to remove flooring materials. As feasible, all removal shall be conducted using wet methods to reduce the release of fibers. If chemical mastic removers are used, follow

the manufacturers recommended procedures.

- B. Remove the asbestos material in small sections. As it is removed, pack the wetted material in impermeable plastic bags (2) of 6 mil minimum thickness. Plastic waste bags will be then placed into waste containers prior to removal from the abatement area. Material shall not be allowed to leak out or dry out prior to insertion into the containers.
 - 1. Contractor shall adhere to disposal authorities' size and weight requirements for containers (bags or packages).
 - 2. All ACM or asbestos-contaminated material that has been removed shall be bagged at the end of each work shift (that is, debris on the floor cannot be allowed to accumulate).
 - 3. All ACM or asbestos-contaminated material which has been bagged or wrapped in the work area cannot be allowed to accumulate; all bagged or wrapped material must be placed in the dumpster after every shift.
- C. Remove bagged or wrapped material to waste load-out area. Re-bag or re-wrap all material in a second impermeable 6 mil bag or second 6 mil layer of plastic, respectively and then place into a waste container, except carpet rolls. Clean external surfaces of bags by wet sponging prior to being put into the waste container. The exterior of the containers shall be wet wiped inside the waste load out decon and place caution labels on containers in accordance with OSHA regulation 29 CFR 1926.58. **No abatement activities may be taking place inside the containment during waste load out. The decon shall be sealed up during waste load out.** Egress through the decon shall take place prior to or after waste load out.
 - 1. **Under no circumstance will waste bags or containers be allowed to be stored inside a building.** The waste will be removed from the containment and **immediately** be transported outside the building and placed into the waste disposal receptacle.
- D. In the event that no work is performed in a given area for any period which exceeds thirty-six (36) hours, all visible ACM on the plastic walls and all bagged and containered ACM or asbestos-contaminated material shall be locked and secured in the dumpster. If the amount of material exceeds the storage capacity of the dumpster, all material must be properly disposed of at the landfill prior to that 36-hour, non-work period.
- E. The chemical mastic remover(s) shall be used in accordance with the manufacturer's directions at all times. Due to the combustible nature of chemical mastic removers, the District reserves the right to limit the amount of mastic remover used at any one time.

2.03 ENCAPSULATION PROCEDURES:

- A. On friable asbestos abatement projects, the State of Nevada requires that air clearance samples be taken prior to encapsulation. Contractors will take direction from the District ES&A personnel

or District hired asbestos consultant to determine if encapsulation will be done prior to taking air clearance samples or after air samples have been sampled to ensure that the project encapsulation activity complies with Nevada regulations. Prior to air clearance sampling or after and upon approval by the Owner, either Contractor shall apply a penetrating encapsulant to bind any remaining non-visible asbestos fibers; encapsulant shall be applied according to manufacturer's directions. Contractor shall submit product information for prior approval by the District.

- B. The encapsulant shall be clear in color. Any encapsulant installed must be compatible with any new products that will be installed over the encapsulate such as flooring products.

2.04 CLEAN-UP

- A. Remove all visible accumulations of asbestos material and debris. Wet clean all surfaces within the work area.
- B. The windows, doors, and HVAC vents shall remain sealed and any HEPA filtered negative air pressure systems, waste load-out, and decontamination enclosure systems shall remain in service.
 - 1. All equipment used in the work area shall be included in the clean-up and shall be removed from work areas via the decontamination enclosure system or waste load-out, at appropriate times in the cleaning sequence.
 - 2. **Under no circumstances will contaminated materials, tools or equipment that has been removed from the containment be allowed to be placed inside a building outside containment.** All items will be **immediately** transported to a lockable storage unit or placed inside a Contractor's vehicle. Items will also not be allowed to accumulate outside of a building.
- C. As directed by the District, clean all remaining surfaces in the work area (including the HVAC system, see Section 02160) and any other contaminated areas with water and with HEPA filtered vacuum equipment. After cleaning the work area, wait an appropriate period of time to allow for settlement of dust, and again wet clean a second time and clean with HEPA filtered vacuum equipment all surfaces in the work area. After completion of the second cleaning operation, perform a complete visual inspection of the work area to ensure that the work area is free of visible asbestos debris.
 - 1. If the District, after the second cleaning finds visible accumulations of asbestos debris in the work area, the Contractor shall repeat the wet cleaning until the work area is in compliance, all at the Contractor's expense.
 - 2. Wet clean as necessary.
 - 3. Remove splash guards as directed by the District.
 - 4. Nothing in this section is meant to relieve the Contractor of his responsibility to meet the

final clean criteria as established by these contract documents or any other applicable laws or regulations.

- D. When a final inspection determines that the work area is free of accumulations of visible asbestos debris, and fiber levels continue to remain at or below .010 fibers/cc the District will proceed with the final TEM clearance sampling (see criteria as set forth in Section 02110, PART 4, 4.01).
- E. WHEN CLEAN-UP IS COMPLETE, AFTER AIR CLEARANCE IS RECEIVED;
 - 1. Remove final polyethylene barriers from windows, doors, corridors, and so on; remove negative air pressure system from area.
 - 2. Relocate objects moved to temporary locations in the course of the work to their former positions.
 - 3. Where applicable, establish HVAC, mechanical and electrical systems in proper working order. Install new filters, furnished by the Owner, and dispose of used filters as asbestos-contaminated waste.
 - 4. When more than one work or containment area is required, install new clean barriers (6 mil plastic or better) to separate adjoining areas.
 - 5. Contractor shall mop the abatement area floor with two coats of a product that will remove any residue but does not void and product being installed over the abatement areas such as flooring materials. Additional coats of clear water will then be mopped onto the floor until the product utilized to do the final wash residue is removed.

2.05 DISPOSAL

- A. As the work progresses, and to prevent exceeding available dumpster storage capacity on site, remove asbestos waste and dispose of such at an authorized disposal site in accordance with the requirements of the disposal authority. Submit documentation regarding disposal to the District. Contractor is responsible for all costs regarding waste including waste characterization sampling.
 - 1. All ACM or asbestos-contaminated material must be double-bagged (or wrapped) in 6 mil bags and then placed into a waste container (drum). All materials that are generated from the asbestos containment must be disposed of as asbestos waste to include the poly containment materials or any other materials used to create the containment that are present inside or with surfaces that are inside the containment.
 - 2. All ACM or asbestos-contaminated material must be damp when delivered to the disposal site.
 - 3. **Under no circumstance will waste bags or containers be allowed to be stored inside a building.** The waste will be removed from the containment and **immediately** be transported outside the building and placed into the waste disposal receptacle.

4. Chemical mastic remover will be separated from the asbestos waste and disposed of in accordance with all applicable regulations. It is the Contractors responsibility to determine the proper disposal based upon the type and amount of mastic remover.
 5. All waste load out activities will be scheduled for and inspected by the Owner.
- B. Sealed plastic bags may be dumped into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled.
- C. Dumpsters or any EPA-approved hazardous waste container system capable of being totally secured can be used in lieu of drums for transport to the disposal site. Absolutely no uncovered, unlockable dumpsters will be allowed to be used as a waste container system. This includes dumpster for construction debris that is associated with an asbestos abatement project. Open dumpsters, vehicles or trailers with wood covering installed will not be allowed for use as a waste container system.
1. All loads are to be delivered in an enclosed vehicle. No open pick-ups will be allowed.
- D. Each load must be accompanied by a Uniform Hazardous Waste Manifest (EPA Form-22) or equivalent and any other certificate required by State or local agencies.
1. Original copies of the Hazardous Waste Manifest shall be provided to the District.

SECTION 02150

WORK SCHEDULE AND INSPECTION PROCEDURES

PART 1 - WORK SCHEDULE

- 1.01 The work is to be carried out diligently to completion with utmost speed. The Contractor shall furnish to the District a final working schedule showing anticipated starting and completion dates for each removal zone or area. This schedule shall be furnished to the District within at least five (5) calendar days from issuance of the District's written Notice to Proceed.
- 1.02 If, in the opinion of the District, it becomes necessary to work additional men for maintaining the schedule and for the completion of any phase of the project within the specified time, the Contractor must immediately do so upon written request by the District.
- 1.03 Work shall proceed immediately upon receipt of Contractor's Notice to Proceed from the District. Facilities shall be available to the Contractor as agreed upon. All work must be completed no later than agreed upon.

PART 2 - INSPECTIONS BY THE DISTRICT

- 2.01 The District shall inspect the site preparation work within the building as outlined in Section 02140, PART 1 to ensure that the facility is adequately sealed off, the negative air pressure system is functioning properly, the decontamination enclosure system, and waste area are in place. The Contractor **SHALL NOT PROCEED** with the gross removal until such time as the District has inspected the site preparation work and given the Contractor a Notice to Proceed (PREP).
- 2.02 The District shall inspect the removal work and work area upon its completion within the building or section thereof to ensure that all visible ACM or asbestos-contaminated material has been removed. The Contractor **SHALL NOT PROCEED** with the next phase of the work or spray any materials on the building systems until such time as the District has inspected the facility and given the Contractor a Notice to Proceed (REMOVAL AND DETAIL).
- 2.03 After encapsulation, the District will inspect the adequacy of encapsulation within each building or section thereof. The Contractor **SHALL NOT PROCEED** with final clean-up until a Notice to Proceed has been issued (ENCAPSULATION).
- 2.04 The District will inspect the facilities on a daily basis as necessary to ensure compliance with this Contract. Representatives of the District may be on-site at all times during the performance of this Contract.
 - A. The District is not limited by the inspection requirements as noted above in Sections 2.01 through 2.03; additional safety and health inspections as well as inspections by the Owner will occur randomly. Contractor will not attempt to control access to asbestos containments to District asbestos personnel.

SECTION 02160

MECHANICAL

PART 1 - SCOPE OF WORK

- 1.01 Remove as directed all HVAC ventilation grilles and registers, including ceiling or wall access panels. Each shall be wet-cleaned and stored by the Contractor except those designated to be disposed of as asbestos waste. Or seal all grilles, registers, and ceiling or wall access panels in plastic sheeting.
- 1.02 Contractor will ensure that the all equipment has been properly locked out and all procedures to secure all equipment, including mechanical equipment, will comply with all requirements of the OSHA and the Districts Lock out/tag out procedures.
- 1.03 As directed by the District, during final cleaning, wet-clean and vacuum all HVAC ventilation ducts with HEPA filtered vacuum equipment.
 - A. Cleaning may include, but is not limited to, the first six feet of all supply, return and exhaust air ducts adjacent to the work area.

SECTION 02170

ELECTRICAL

PART 1 - SCOPE OF WORK

- 1.01 Disconnect all circuits in the work area at the main panel box and lock out same as approved by the District.
- 1.02 Where required, remove all existing electrical fixtures including, but not limited to, ceiling and wall lights, clocks, alarms, and sound system fixtures. Each shall be wet-cleaned, location tag attached and store as directed by the District.
 - A. Nonfunctional electrical fixtures or systems shall be brought to the attention of the District in writing prior to commencement of work. Failure to notify the District in writing of any nonfunctional electrical fixtures or systems will not act to relieve the Contractor of the provisions of Section 02170, PART 2, 2.04.
- 1.03 Protect all exposed wires.
- 1.04 Contractor will ensure that the all equipment has been properly locked out and all procedures to secure all equipment, including electrical equipment, will comply with all requirements of the OSHA and the Districts Lock out/tag out procedures.

SECTION 02180

RESTORATION

PART 1 - RESTORATION WORK

- 1.01 Existing conditions disturbed by the Contractor's operations shall be restored to a condition satisfactory to the District and shall match existing adjacent surfaces. Damage due to tape, staples, nails, spray-poly, water, including unforeseen actions, is the responsibility of the Contractor and must be restored to the prior to final acceptance of the facility by the District.
- 1.02 The Contractor shall survey and detail all existing damage to walls, floors and floor coverings, fixtures and so on. This survey shall be submitted to the District in writing prior to set-up and preparation of the worksite.
- 1.03 All restoration must be completed within two weeks after the abatement project containment is torn down. Failure to complete the restoration in the two week time frame will result in the District hiring an outside vendor to complete the restoration. The cost of services for the restoration will be deducted from the projects final payments or any payments outstanding to the contractor.
- 1.04 The contractor is responsible for supplying all labor and materials to properly perform the restoration.
- 1.05 The contractor is responsible for the security of items removed by the contractor that require reinstallation. The District assumes not responsibility for the security of items left in District facilities. The contractor is responsible for replacing at no cost to the District any item removed by the contractor that is found to be missing or damaged at the time of reinstallation.

PART 2 - WALL AND FLOOR COVERING

- 2.01 It is the Contractor's responsibility to ensure that all wall areas are adequately sealed with 6 mil plastic in order to prevent water accumulation and asbestos contamination. Any wall material which is stained or otherwise damaged during any phase of the work shall be replaced in its entirety with materials of equal quality and selected by the District.
- 2.02 The Contractor shall restore all painted, varnished, lacquered, paneled or enameled surfaces (including factory finished surfaces) should damage occur from tape, staples, nails, water, and so on. Should such procedures be unacceptable to the District, the District may require, at its option, the entire replacement, refinishing, repainting or resurfacing of the damaged surface area.

PART 3 - FIXTURES

- 3.01 Any electrical fixtures, HVAC grilles, registers, and access doors lost or damaged by the Contractor shall be replaced at Contractor's expense.
- 3.02 Any other fixtures, furniture, appliances, and equipment not specifically mentioned must be replaced or repaired at Contractor's expense if lost or damaged.

PART 4 - SEWER SYSTEM

- 4.01 Should the Contractor, his employees, or subcontractors utilize existing sewer facilities for disposal of any ACM, asbestos contaminated material, or asbestos contaminated water, Contractor shall thoroughly clean the entire building's sewage system including, but not limited to, all sink, shower, floor, and toilet drains and traps, all primary and secondary sewage lines, and all lines wherever located and extending underground to the main sewer service connection.

PART 5 - EXTERIOR OF BUILDING

- 5.01 It is the Contractor's responsibility to repair or replace any and all damaged external areas of the building including, but not limited to, walls, doors, sidewalks, driveways, parking lots, concrete curbs, shrubbery, grass, sprinkler systems, and so on.
 - A. Damaged areas will be repaired or replaced at the option of the District.
- 5.02 Any ground areas external to the building which may become contaminated with asbestos shall be decontaminated at the Contractor's expense.
 - A. Decontamination procedures shall require removal of dirt to a depth of 4 inches which shall be disposed of as asbestos waste.
 - B. All areas from which soil was decontaminated shall be restored to its original condition at the option of the District.

SECTION 02190

TRANSITE SUPPLEMENTAL SPECIFICATIONS

Asbestos Abatement Specifications Washoe County School District Transite Panels at District Sites

Background

Washoe County School District (WCSD) will be performing the abatement of transite wall, ceiling panels, pipes and/or window panels at various District sites. This supplemental spec as well as the District specs will apply to the removal of all transite materials. The abatement contractor shall be prepared to abate the transite materials as identified in the site-specific architectural drawings provided for the individual site or information provided prior to bidding.

The contractor will need to note when additional asbestos-containing materials are to be abated within the same containment area and perform that work within the same negative pressure enclosure, if applicable. The contractor's onsite supervisor, or project estimator during bidding, will need to confer with either WCSD or the District's independent third-party consultant, for the expected containment areas and number of containments at a particular site.

Scope of Work

The contractor awarded the project will be responsible for all costs associated with the abatement of the transite.

The project scope shall be determined by the site-specific architectural drawings prepared for the individual site. The Contractor is responsible for reviewing the architectural drawings and the WCSD Regulated Systems and Assessment (ES&A) Material Disturbance Permit to determine which materials, including any sealants, in the project area are asbestos-containing.

The District has retained an independent third-party abatement consultant to draft these specifications, who may provide oversight during the projects, conduct visual clearance inspections and collect clearance air samples at the conclusion of these abatement projects. All oversight or additional oversight and collection of air samples may be performed by the District's ES&A Department as well as at their discretion.

In addition to complying with these supplemental specifications, the Contractor must also comply with all other asbestos abatement requirements listed in these asbestos abatement specifications. If Contractors find any conflicting information in the supplemental specifications, the Contractor must comply with the requirements listed herein that are deemed most stringent by the District or District hired asbestos consultant supervising the abatement.

Project Requirements

Contractor shall be approved by the WCSD ES&A Department to perform asbestos abatement activities within the District. **Approval of firms that have not performed activities impacting asbestos for the District previously, will need to submit all necessary documentation outlined in the WCSD ES&A Technical Specifications for the project at least ten (10) business days prior to work commencing for approval.**

All workers certifications – asbestos training and licensing and medical clearance – shall be submitted to the WCSD ES&A at least five (5) working days prior to project commencement at minimum for approval. Contractor is responsible for reviewing WCSD ES&A worker roster for the company to assure all workers to be used on the project have been approved prior to arrival onsite. Workers not identified on the approved worker list for the contractor will not be allowed to perform any activities onsite, even if documentation is provided onsite at time of the project commencement.

The abatement contractor's onsite supervisor shall have a copy of these Specifications onsite at all times and be familiar with the project requirements prior to arrival onsite at the project. Failure to follow requirements of these Specifications, or lack of knowledge of requirements to be followed during the project, are grounds for replacement of the abatement contractor's onsite supervisor.

Only the abatement contractor will be allowed to occupy the project area once abatement activities are scheduled to start. This applies to all WCSD non-ES&A staff/personnel and site staff/personnel. The area shall only be occupied by the abatement contractor, WCSD ES&A staff, and District's independent third-party abatement consultant. Other personnel will not be allowed to occupy the building during asbestos abatement activities.

Contractor shall adhere to the requirements of these Specifications, WCSD ES&A Technical Specifications, Federal, State, and Local regulations.

Water and Electricity

Water and electricity are available onsite, but long hoses and cords may be necessary. The contractor is responsible for any damage to water or power systems caused by their use of those systems.

Contractor shall provide a GFI at the primary plug-in of all electrical trains used for electrical equipment. Hose washers shall be provided at all hose connections to prevent leakage of water and potential damage to District facilities.

Pre-Cleaning

Pre-cleaning is not expected to be necessary; however, Contractor may need to remove some debris or clean surfaces to facilitate building containment area.

Notifications

Contractor is responsible for timely notifications (including courtesy notifications if applicable) to Nevada Division of Industrial Relations and Washoe County Health Department. Notifications shall be filed in advance of any waiting periods in lieu of the proposed project start date or other requirements for pre-work notification. Any revisions to notifications including project scope, start date, duration of project, or any other changes are the Contractor's responsibility. Valid notifications shall be posted onsite during the project, and copies shall be provided to the District's onsite third-party consultant.

Equipment

Contractor is responsible for providing all necessary equipment in sufficient quantities to complete the project in the schedule provided for the project. All equipment must arrive onsite clean and in proper functioning order. Any equipment that arrives onsite dirty or not in proper functioning order shall be removed from the project site for cleaning and/or repairs.

Training

Workers performing asbestos abatement activities as part of this project must have AHERA Worker training with at least one worker trained to the AHERA Contractor-Supervisor level. All workers shall be licensed by the Nevada DIR for asbestos work. The crew lead Contractor-Supervisor may not leave the site anytime asbestos abatement operations are being performed.

As noted previously, all workers certifications must be approved by the WCSD ES&A prior to arrival onsite to start work. Copies of the worker certs shall be provided to the District's onsite third-party consultant as well.

Personal Protection Equipment

The contractor is responsible for adhering to Nevada Division of Industrial Relations and OSHA requirements for worker respiratory protection. At a minimum, workers shall wear half-face, negative pressure respirators with HEPA (P-100) filters during any activities which disturb asbestos-containing materials.

Workers shall wear Tyvek-level disposable coveralls, hard hats, work gloves, and safety glasses (if not using a full face-piece respirator.) Street clothes may be worn under disposable coveralls.

All employees shall have a valid medical clearance and fit test for respirators to be used. Medical clearance shall be provided for approval to the WCSD ES&A prior to the project commencement. Copies of the medical clearance and fit test shall be provided to the District's onsite third-party consultant as well.

Personal Air Monitoring

The contractor is responsible for the collection of personal air samples on workers during all abatement activities for asbestos. Personal air samples shall be collected in accordance with OSHA sampling protocols and analyzed by a laboratory with the proper accreditation.

Laboratories to be used for personal air sample analysis must be approved by WCSD ES&A.

Copies of the personal air sampling results, along with laboratory accreditation, shall be submitted to the WCSD ES&A and District's independent third-party consultant.

In addition, the contractor will comply with all requirements regarding personal air monitoring listed in Section 02130, Part 2- - Air Monitoring, 2.02.

Security and Safety

The contractor is responsible for security of all equipment and safety of all employees. Contractor shall provide any storage containers or security needed for tools and equipment if needed.

Contractor is responsible for all worker safety and following all applicable regulations, namely Nevada and Federal OSHA, including for asbestos and respirable crystalline silica exposures.

Occupancy

As noted previously, the project area will be limited to the abatement contractor, WCSD ES&A staff, and District's independent third-party consultant once abatement activities are ready to commence. Once the area has been cleared, other parties may occupy.

Emergency services may also occupy areas in the event of an emergency during the project.

Challenge Testing

All HEPA-filtered equipment to be used on this project shall have been challenge tested (DOP or equivalent) within the previous 30 days prior to use onsite. Copies of the challenge testing results shall be provided to the WCSD ES&A and/or District's independent third-party consultant.

Asbestos Abatement Containment and Abatement Requirements

ALL POLY USED ON PROJECT SHALL BE 6-MIL AND FIRE-RETARDANT UNLESS EXEMPTED IN REQUIREMENTS BELOW.

WHERE POSSIBLE, TRANSITE PANELS SHALL BE REMOVED FROM THE EXTERIOR SIDE.

Interior Transite Panel Abatement

1. Contractor shall seal all critical barriers (HVAC, windows, doors, etc.) in each area with one layer of 6-mil poly. Doors leading outside of the containment area shall remain in place for security.

2. All walls, floors, and any fixed objects that cannot be removed from the containment shall be covered with one layer of 6-mil poly. An additional layer of 4-mil poly may be applied to covered surfaces for use as a cleaning barrier. Vertical barriers may be installed to decrease the size of containment areas; however, such barriers shall be constructed with wood framing and ½" plywood backing.
3. Poly critical barriers with wood framed ½" plywood backing shall be installed on the exterior side of the transite panel to contain the interior space and secure the wall opening. Two layers of poly shall be used to cover the plywood with an additional two layers installed on exterior side of the plywood which will extend out 2" on each side of the plywood.
4. A minimum three-stage decontamination unit with operable shower shall be contiguous with each containment. See "Decontamination Chamber Requirements" in this specification for further requirements.
5. Negative pressure shall be established and a recording manometer shall be attached to each containment. Copies of the manometer recordings shall be provided on 8.5"x11" paper by the Contractor.
6. An air pressure differential of -0.050" WC must be established and maintained throughout all phases of abatement and through receipt of passing air clearance.
7. Workers shall wet all materials prior to, and during, removal using amended water.
8. Transite panels shall be removed intact wherever possible.
9. Any sealants at edges of transite panels, or other suspect materials that may need to be disturbed by the transite panel removal shall be considered to be asbestos-containing materials unless sampled and proven otherwise.
10. Following removal of all transite panels, all poly shall be wet-wiped or HEPA-vacuumed clean as part of detail cleaning. Any 4-mil poly cleaning barriers may be removed as part of this detail cleaning.
11. All waste shall be placed into two separate waste bags of 6-mil thickness. The outer waste bag shall be sealed in a "goose-neck" fashion to create a leak-tight container.

Exterior Transite Panel Abatement

1. Contractor shall seal all critical barriers (HVAC, windows, doors, etc.) within 20 feet of the work area with one layer of 6-mil poly.
2. Poly drop sheets shall be installed in the work area, extending 20 feet out from any transite panel to be removed, and this work area shall be demarcated with warning signs / tape. The Contractor shall control access to this regulated area to a distance of 50 feet out, demarcating the perimeter with caution tape.

3. Poly critical barriers with wood framed ½" plywood backing shall be installed on the interior side of the transite panel to seal off the interior space and secure the wall opening. The plywood will be covered with two layers of 6-mil poly on both the interior and exterior side. The interior poly barriers shall extend out two inches on each side.
4. Decontamination facilities shall be sited adjacent to the work area, and shall include a drop sheet. A water source shall be provided, along with soap and towels. Dirty water shall be contained. A privacy barrier shall also be installed as needed.
5. Workers shall wet all materials prior to, and during, removal using amended water.
6. Transite panels shall be removed intact wherever possible.
7. Any sealants at edges of transite panels, or other suspect materials that may need to be disturbed by the transite panel removal shall be considered to be asbestos-containing materials unless sampled and proven otherwise.
8. Following removal of all transite panels, all poly shall be wet-wiped or HEPA-vacuumed clean as part of detail cleaning.
9. All waste shall be placed into two separate waste bags of 6-mil thickness. The outer waste bag shall be sealed in a "goose-neck" fashion to create a leak-tight container.

Decontamination Requirements

A three stage decon unit including a shower is required for any interior asbestos containments. Each chamber of the decon must have self-closing Z-flaps that seal air tight. A four-inch barrier must exist at the floor of each chamber to prevent the transfer of water and debris from chamber to chamber. This barrier will also provide a seal for the flaps between each chamber. Equipment and bag out chambers do not require a shower, but a washing station must exist and they must be three-stages. The washing station must be constructed in a manner that prevents water from splashing or traveling out of the central decon chamber. Equipment and bag out chambers must also have flaps that seal air tight.

Shower units must be equipped with an overflow pan to catch water which overfills the drain system, or is splashed out of the chamber during employee showers. Showers must be supplied with hot water, soap, shampoo, and towels for the workers. Showers shall be sited in the central decon chamber. Showers and washing station must also be equipped with a filtering system that includes a 0.5 micron filter. If filtering system is not available or is not functioning correctly, shower water must be bagged and disposed of as asbestos-containing waste.

All chambers of the decon, including the clean chamber, must be kept clean and dry (except shower) at all times. Abatement work will be stopped if decon is not kept in acceptable condition.

Regulated Area Signage

Asbestos Danger signs shall be posted at all entrances or exits to the containment area, even if the entrance or exit is sealed as a critical barrier. Signs shall also be posted on the flap leading into the shower station of

decontamination chambers. Signage will be set once a pre-start visual is passed and work may begin in the containment, but no work will start until all signs are posted. Signage shall meet the revised requirements set forth in 29 CFR 1926.1101(k)(7).

Air Pressure Differential – Full Containment Areas Only

Air pressure differential must be established and maintained at -0.05 inches water differential or better before start of abatement and air pressure differential must be maintained through all phases of project, including collection of clearance air samples and receipt of results. A minimum of eight air changes per hour is required for the project. Work will be halted if the air pressure drops below -0.05 inches water differential and can resume when air pressure differential of -0.05 inches is established again.

Air pressure differential must be displayed and recorded on a properly calibrated and fully functioning manometer. Copies of the manometer recording must be provided by the contractor on 8.5" x 11" paper at completion of project.

All negative air machines must be exhausted to the exterior of the building using wire-reinforced flex duct. All negative air machines must be used inside containment. No machines shall be attached to the exterior of the containment with the intake only inside.

Any exterior or interior barricades need to be constructed of a minimum ½" plywood and shall be made secure.

Make-Up Air Sources

Available, but may need to be HEPA-filtered. Any make-up holes in critical barriers must be equipped with a challenge/DOP-tested HEPA filter. Placing a pre-filter in the make-up air hole will not be allowed.

Disposal Requirements

All asbestos waste generated on this project will need to be double-bagged in 6-mil poly waste bags, or double-wrapped in 6-mil polyethylene sheeting. All waste bags must be sealed in a "gooseneck" fashion and "burrito-wrapped" materials shall have staggered seams. All non-friable debris shall be properly labeled and identified for disposal as an asbestos-containing waste. Materials that have become friable or which removal methods have made friable shall be labeled and identified for disposal as regulated asbestos-containing material (RACM).

The contractor will need to provide a lockable waste bin for all waste created on this project. Waste bin will need to be labeled with asbestos signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded.

Waste bins will need to arrive onsite clean of debris or any other waste and in proper functioning order. Waste bins may be rejected by WCSD ES&A staff or District's independent third-party consultant if these conditions are not met, with no extra charge to the District.

Clearance

Upon completion of asbestos abatement activities, a final visual inspection will be performed by either WCSD ES&A staff or District's independent third-party consultant. This inspection will be performed only after the abatement contractor crew supervisor has performed their own final visual clearance. Areas must be free of all three-dimensional material with all surfaces clean of dust and debris and all materials abated within the containment area.

The visual inspection will serve as final clearance for exterior transite panel removal. Following a successful visual clearance inspection, the Contractor shall apply a lock-down encapsulant, then remove containment drop sheets, signage, equipment, etc. The barriers at window / wall openings shall be left in place.

For interior removal of transite panels within full containment, final clearance shall be through aggressive air sampling conducted by the District's independent third-party consultant. A set of five air samples will be collected inside the containment to be analyzed in accordance with AHERA completion of response action criteria using either phase contrast microscopy (PCM) or transmission electron microscopy (TEM), depending on the quantity of materials abated.

Clearance criteria for PCM sample analysis, in accordance with AHERA, is 0.01 fibers per cubic centimeter (0.01 f/cc) or less for each of the five samples.

Clearance criteria for TEM sample analysis, in accordance with AHERA, is an average of 70 structures per square millimeter (70 s/mm²) or fewer for the inside-containment set of five samples.

Contractor shall return to the site to apply a lock-down encapsulant, remove poly barriers and equipment upon notification of passing clearance air samples. The barriers at window / wall openings shall be left in place.

SECTION 02200

SUPPLEMENTAL FLOOR TILE & MASTIC SPECIFICATIONS

Asbestos Abatement Specifications Washoe County School District Floor Tile and Mastic at District Sites

Background

Washoe County School District (WCSD) will be performing the abatement of vinyl floor tile (VFT) and mastic at various District sites. This supplemental spec as well as the District specs will apply to the removal of all Floor Tile and Mastic materials. The abatement contractor shall be prepared to abate flooring materials as identified in the site-specific architectural drawings provided for the individual site or information provided prior to bidding.

The contractor will need to note when additional asbestos-containing materials are to be abated within the same containment area and perform that work within the same negative pressure enclosure. The contractor's onsite supervisor, or project estimator during bidding, will need to confer with either WCSD or the District's independent third-party consultant, for the expected containment areas and number of containments at a particular site.

Scope of Work

The contractor awarded the project will be responsible for all costs associated with the abatement of flooring materials.

The project scope shall be determined by the site-specific architectural drawings prepared for the individual site. The Contractor is responsible for reviewing the architectural drawings and the WCSD Regulated Systems and Assessment (ES&A) Material Disturbance Permit to determine which materials, including baseboards and mastic, in the project area are asbestos-containing.

The District has retained an independent third-party abatement consultant to draft these specifications, who may provide oversight during the projects, conduct visual clearance inspections and collect clearance air samples at the conclusion of these abatement projects. All oversight or additional oversight and collection of air samples may be performed by the District's ES&A Department as well at their discretion.

In addition to complying with these supplemental specifications, the Contractor must also comply with all other asbestos abatement requirements listed in these asbestos abatement specifications. If Contractors find any conflicting information in the supplemental specifications, the Contractor must comply with the requirements listed herein that are deemed most stringent by the District or District hired asbestos consultant supervising the abatement.

Most floors in the District are concrete, but wood floors may be encountered. Since cleaning flooring mastics are difficult if not impossible on wood floors, whenever there is more than is one layer of flooring sub-floor, one layer will be removed as a part of the abatement process and properly disposed as asbestos containing materials.

Project Requirements

Contractor shall be approved by the WCSD ES&A Department to perform asbestos abatement activities within the District. **Approval of firms that have not performed activities impacting asbestos for the District previously, will need to submit all necessary documentation outlined in the WCSD ES&A Technical Specifications for the project at least ten (10) business days prior to work commencing for approval.**

All workers certifications – asbestos training and licensing and medical clearance – shall be submitted to the WCSD ES&A at least five (5) working days prior to project commencement at minimum for approval. Contractor is responsible for reviewing WCSD ES&A worker roster for the company to assure all workers to be used on the project have been approved prior to arrival onsite. Workers not identified on the approved worker list for the contractor will not be allowed to perform any activities onsite, even if documentation is provided onsite at time of the project commencement.

The abatement contractor's onsite supervisor shall have a copy of these Specifications onsite at all times and be familiar with the project requirements prior to arrival onsite at the project. Failure to follow requirements of these Specifications, or lack of knowledge of requirements to be followed during the project, are grounds for replacement of the abatement contractor's onsite supervisor.

Only the abatement contractor will be allowed to occupy the project area once abatement activities are scheduled to start. This applies to all WCSD non-ES&A staff/personnel and site staff/personnel. The area shall only be occupied by the abatement contractor, WCSD ES&A staff, and District's independent third-party abatement consultant. Other personnel will not be allowed to occupy the building during asbestos abatement activities.

Contractor shall adhere to the requirements of these Specifications, WCSD ES&A Technical Specifications, Federal, State, and Local regulations.

Water and Electricity

Water and electricity are available onsite, but long hoses and cords may be necessary. The contractor is responsible for any damage to water or power systems caused by their use of those systems.

Contractor shall provide a GFI at the primary plug-in of all electrical trains used for electrical equipment. Hose washers shall be provided at all hose connections to prevent leakage of water and potential damage to District facilities.

Pre-Cleaning

Pre-cleaning is not expected to be necessary; however, Contractor may need to remove some debris or clean surfaces to facilitate the building of negative pressure enclosure.

Notifications

Contractor is responsible for timely notifications (including courtesy notifications if applicable) to Nevada Division of Industrial Relations and Washoe County Health Department. Notifications shall be filed in advance of any waiting periods in lieu of the proposed project start date or other requirements for pre-work notification. Any revisions to notifications including project scope, start date, duration of project, or any other changes are the Contractor's responsibility. Valid notifications shall be posted onsite during the project, and copies shall be provided to the District's onsite third-party consultant.

Equipment

Contractor is responsible for providing all necessary equipment in sufficient quantities to complete the project in the schedule provided for the project. All equipment must arrive onsite clean and in proper functioning order. Any equipment that arrives onsite dirty or not in proper functioning order shall be removed from the project site for cleaning and/or repairs.

Training

Workers performing asbestos abatement activities as part of this project must have AHERA Worker training with at least one worker trained to the AHERA Contractor-Supervisor level. All workers shall be licensed by the Nevada DIR for asbestos work. The crew lead Contractor-Supervisor may not leave the site anytime asbestos abatement operations are being performed.

As noted previously, all workers certifications must be approved by the WCSD ES&A prior to arrival onsite to start work. Copies of the worker certs shall be provided to the District's onsite third-party consultant as well.

Personal Protection Equipment

The contractor is responsible for adhering to Nevada Division of Industrial Relations and OSHA requirements for worker respiratory protection. At a minimum, workers shall wear half-face, negative pressure respirators with HEPA (P-100) filters during any activities which disturb asbestos-containing materials.

Workers shall wear Tyvek-level disposable coveralls, hard hats, work gloves, and safety glasses (if not using a full face-piece respirator.) Street clothes may not be worn under disposable coveralls.

All employees shall have a valid medical clearance and fit test for respirators to be used. Medical clearance shall be provided for approval to the WCSD ES&A prior to the project commencement. Copies of the medical clearance and fit test shall be provided to the District's onsite third-party consultant as well.

Personal Air Monitoring

The contractor is responsible for the collection of personal air samples on workers during all abatement activities for asbestos. If removal activities or methods are expected to disturb any substrates which contain silica, the contractor is also responsible for collection of personal air samples for respirable crystalline silica

exposure. Asbestos and silica personal air samples shall be collected in accordance with OSHA sampling protocols and analyzed by a laboratory with the proper accreditation.

Laboratories to be used for personal air sample analysis must be approved by WCSD ES&A.

Copies of the personal air sampling results, along with laboratory accreditation, shall be submitted to the WCSD ES&A and District's independent third-party consultant.

In addition, the contractor will comply with all requirements regarding personal air monitoring listed in Section 02130, Part 2- - Air Monitoring, 2.02.

Security and Safety

The contractor is responsible for security of all equipment and safety of all employees. Contractor shall provide any storage containers or security needed for tools and equipment if needed.

Contractor is responsible for all worker safety and following all applicable regulations, namely Nevada and Federal OSHA, including for asbestos and respirable crystalline silica exposures.

Occupancy

As noted previously, the project area will be limited to the abatement contractor, WCSD ES&A staff, and District's independent third-party consultant once abatement activities are ready to commence. Once the area has been cleared, other parties may occupy.

Emergency services may also occupy areas in the event of an emergency during the project.

Challenge Testing

All HEPA-filtered equipment to be used on this project shall have been challenge tested (DOP or equivalent) within the previous 30 days prior to use onsite. Copies of the challenge testing results shall be provided to the WCSD ES&A and/or District's independent third-party consultant.

Asbestos Abatement Containment and Abatement Requirements

ALL POLY USED ON PROJECT SHALL BE 6-MIL AND FIRE-RETARDANT UNLESS EXEMPTED IN REQUIREMENTS BELOW.

Vinyl Floor Tile and Mastic Abatement

1. Contractor shall seal all critical barriers (HVAC, windows, doors, etc.) in each containment area with one layer of 6-mil poly. Doors leading outside of the containment area shall remain in place for security.
2. The contractor shall setup a regulated area and abate those areas of tiles that extend below door threshold prior to sealing of doorways as critical barriers as applicable.

3. All walls and any fixed objects that cannot be removed from the containment shall be covered with one layer of 6-mil poly. One additional layer of 4-mil poly may extend up from the floor to a height of 4' to act as a cleaning barrier.
4. A false-ceiling, minimum of 4-mil poly, shall be installed as directed by the owner or if needed to achieve and maintain sufficient negative air pressure differential as noted below. Mastic to be removed by hydro-blasting or grinding will require installation of a 4-mil poly ceiling. See hydro-blasting and grinding sections below.
5. A minimum three-stage decontamination unit with operable shower shall be contiguous with each containment. See "Decontamination Chamber Requirements" in this specification for further requirements.
6. Negative pressure shall be established and a recording manometer shall be attached to each containment. Copies of the manometer recordings shall be provided on 8.5"x11" paper by the Contractor to the District and third-party independent consultant.
7. An air pressure differential of -0.050" WC must be established and maintained throughout all phases of abatement and through receipt of passing air clearance.
8. Workers shall wet all materials prior to, and during, removal using amended water.
9. Baseboard removal shall not take place until containment is established.
10. At the conclusion of abatement, the floor surface shall be HEPA-vacuumed clean and all mastic removed. The criteria for mastic removal shall be no three-dimensional material, including mastic that may have become liquefied and entered slab divots, joints, or any other areas during the removal process.
11. All poly shall be wet-wiped or HEPA-vacuumed clean as part of detail cleaning. The 4-mil poly cleaning barrier may be removed as part of this detail cleaning unless required for maintaining sufficient air pressure differential.
12. All waste shall be placed into two separate waste bags of 6-mil thickness. The outer waste bag shall be sealed in a "gooseneck" fashion to create a leak-tight container.

For the hydro-blasting of the concrete substrate to remove mastic and for areas which must have the top surface of the concrete removed, as directed by the flooring subcontractor(s), the following requirements must be met by the Contractor:

1. For hydro-blasting, a full negative pressure containment must be constructed, including a ceiling of 4-mil poly.

2. All critical barriers must be sealed with one layer of 6-mil poly. Any fixed objects that cannot be moved out of the containment area shall be covered with one layer of 6-mil poly.
3. Contractor shall use a hydro-blasting unit to “power wash” the floors clear of mastic, including any cracks or seams in the concrete slab. This system shall have a man-operated unit that will capture the water with vacuum pressure at the front of the machine as it is operating to prevent the build-up of water in the containment.
4. The hydro-blasting unit shall be set to remove mastic on the substrate surface, cracks, and seams, without damage to the concrete slab. For areas where the top surface layer of the concrete is to be removed, at the direction of the flooring subcontractor(s), the abatement contractor shall set the hydro-blasting unit to remove the surface to a depth specified by the flooring subcontractor(s).
5. The abatement contractor shall anticipate the unit not being able to hydro-blast all areas of the containment (corners, along walls) and shall plan to use alternate methods to remove mastic or the top concrete surface in such areas. Any mechanical means to remove the mastic will need to have HEPA-filtered local exhaust.
6. At the conclusion of the hydro-blasting, the abatement contractor shall clean the floor of the containment using HEPA-vacuums followed by wet-cleaning, and HEPA-vacuuming again to assure that surfaces have been cleaned sufficiently.
7. All poly surfaces, including the ceiling, shall be wet-wiped clean as part of detail cleaning.
8. Contractor shall perform treatment of waste water prior to discharge if water will not be treated as a hazardous waste. Waste water must meet the levels of requirements provided in City of Reno Municipal Code 12.16.565.
9. Contractor shall follow all requirements, including collection of any necessary permits, for the discharge of contaminated water as required by City of Reno Municipal Code 12.16.
10. If abatement contractor will dispose of all water, they shall be responsible for profiling water for disposal. Copies of the waste profile results, along with chain of custody, shall be provided to HMS, Inc. Project Manager prior to disposal.

For the grinding of concrete floor surfaces, the work shall be performed within the same containment erected for floor tile and mastic abatement (as applicable). If areas being ground are not within a contained area (such as non-asbestos floor removal), a negative pressure enclosure shall be constructed as listed in the hydro-blasting section above. In addition to the requirements as noted above, the following engineering controls shall be met by the contractor performing the grinding of floor surfaces.

1. All power equipment to be used for the grinding of concrete floor surfaces shall have an approved shroud system that provides local exhaust.

2. A HEPA-vacuum shall be attached to the shroud system to provide the local exhaust.
3. An airless sprayer or equivalent shall be used to provide water for the suppression of any visible emissions that may be released by the work and to keep surfaces wet prior to cleaning.
4. All slurries or dust remaining within the containment area shall be HEPA-vacuumed cleaned. Additional wet-wiping to assure all dust has been cleaned in the containment area may be required.

Decontamination Requirements

A three stage decon unit including a shower is required for asbestos containments. Each chamber of the decon must have self-closing Z-flaps that seal air tight. A four-inch barrier must exist at the floor of each chamber to prevent the transfer of water and debris from chamber to chamber. This barrier will also provide a seal for the flaps between each chamber. Equipment and bag out chambers do not require a shower, but a washing station must exist and they must be three-stages. The washing station must be constructed in a manner that prevents water from splashing or traveling out of the central decon chamber. Equipment and bag out chambers must also have flaps that seal air tight.

Shower units must be equipped with an overflow pan to catch water which overfills the drain system, or is splashed out of the chamber during employee showers. Showers must be supplied with hot water, soap, shampoo, and towels for the workers. Showers shall be sited in the central decon chamber. Showers and washing station must also be equipped with a filtering system that includes a 0.5 micron filter and heated water. If a filtering system is not available or is not functioning correctly, shower water must be bagged and disposed of as asbestos-containing waste with no extra compensation being given to the Contractor.

All chambers of the decon, including the clean chamber, must be kept clean and dry (except shower) at all times. Abatement work will be stopped if decon is not kept in acceptable condition.

Regulated Area Signage

Asbestos Danger signs shall be posted at all entrances to the containment area, even if the entrance is sealed as a critical barrier. Signs shall also be posted on the flap leading into the shower station of decontamination chambers. Signage will be set once a pre-start visual is passed and work may begin in the containment, but no work will start until all signs are posted.

Signage shall meet the revised requirements set forth in 29 CFR 1926.1101(k)(7).

Air Pressure Differential

Air pressure differential must be established and maintained at -0.05 inches water differential or better before start of abatement and air pressure differential must be maintained through all phases of project, including collection of clearance air samples and receipt of results. A minimum of eight air changes per hour is required for the project. Work will be halted if the air pressure drops below -0.05 inches water differential and can resume when air pressure differential of -0.05 inches is established again.

Air pressure differential must be displayed and recorded on a properly calibrated and fully functioning

manometer. Copies of the manometer recording must be provided by the contractor on 8.5" x 11" paper at completion of project.

All negative air machines must be exhausted to the exterior of the building using wire-reinforced flex duct. All negative air machines must be used inside containment. No machines shall be attached to the exterior of the containment with the intake only inside.

Any exterior barricades need to be constructed of a minimum 1/2" plywood and lockable for security. Contractor is responsible for providing a lock to any exterior barricades, and keys shall be provided to WCSD site facilities coordinator and District's independent third-party consultant.

Make-Up Air Sources

Available, but may need to be HEPA-filtered. Any make-up holes in critical barriers must be equipped with a challenge/DOP-tested HEPA filter. Placing a pre-filter in the make-up air hole will not be allowed.

Disposal Requirements

All asbestos waste generated on this project will need to be double-bagged in 6-mil poly waste bags. At least one of the waste bags must be sealed in a "gooseneck" fashion. All non-friable debris shall be properly labeled and identified for disposal as an asbestos-containing waste. Materials that have become friable or which removal methods have made friable shall be labeled and identified for disposal as regulated asbestos-containing material (RACM).

The contractor will need to provide a lockable waste bin for all waste created on this project.

Waste bin will need to be labeled with asbestos signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded.

Waste bins will need to arrive onsite clean of debris or any other waste and in proper functioning order. Waste bins may be rejected by WCSD ES&A staff or District's independent third-party consultant if these conditions are not met, with no extra charge to the District.

Clearance

Upon completion of asbestos abatement activities, a final visual inspection will be performed by either WCSD ES&A staff or District's independent third-party consultant. This inspection will be performed only after the abatement contractor crew supervisor has performed their own final visual clearance. Areas must be free of all three-dimensional material with all surfaces clean of dust and debris and all materials abated within the containment area. Once the containment has been successfully visually inspected and cleared, the Contractor shall apply a lock-down encapsulant to contaminated surfaces in the containment area. The contractor will need to use care to not apply encapsulant to floor surfaces which may prevent adhesion of new flooring materials.

Final clearance shall be through aggressive air sampling conducted by the District's independent third-party

consultant or a District AHERA certified technician. A set of five air samples will be collected inside the containment to be analyzed in accordance with AHERA completion of response action criteria using either phase contrast microscopy (PCM) or transmission electron microscopy (TEM), depending on the quantity of materials abated.

Clearance criteria for PCM sample analysis, in accordance with AHERA, is 0.01 fibers per cubic centimeter (0.01 f/cc) or less for each of the five samples.

Clearance criteria for TEM sample analysis, in accordance with AHERA, is an average of 70 structures per square millimeter (70 s/mm²) or fewer for the inside-containment set of five samples.

Contractor shall return to the site to remove poly barriers and equipment upon notification of passing clearance air samples. Contractor is also responsible for washing the floor using an approved detergent cleaner and water to provide a clean surface for the new floor installation.

In the event that floor grinding is required to be completed within the same containment area, clearance air samples will be collected at the conclusion of grinding and cleaning of the surfaces within the containment area.

**Supplemental Asbestos Abatement Specifications
Washoe County School District
Thermal System Insulation at District Sites**

Background

Washoe County School District (WCSD) will be performing the abatement of thermal system insulation (TSI) materials at various District sites. This supplemental spec as well as the District specs will apply to the removal of all asbestos containing Thermal System Insulation. The abatement contractor shall be prepared to abate TSI materials as identified in the site-specific architectural drawings provided for the individual site or information provided prior to bidding.

The contractor will need to note when additional asbestos-containing materials are to be abated within the same containment area and perform that work within the same negative pressure enclosure. The contractor's onsite supervisor, or project estimator during bidding, will need to confer with either WCSD or the District's independent third-party consultant, for the expected containment areas and number of containments at a particular site.

Scope of Work

The contractor awarded the project will be responsible for all costs associated with the abatement of TSI materials.

The project scope shall be determined by the site-specific architectural drawings prepared for the individual site. The Contractor is responsible for reviewing the architectural drawings and the WCSD Regulated Systems and Assessment (ES&A) Material Disturbance Permit to determine which TSI materials in the project area are asbestos-containing and will be required to be abated.

The District has retained an independent third-party abatement consultant to draft these specifications, who may provide oversight during the projects, conduct visual clearance inspections and collect clearance air samples at the conclusion of these abatement projects. All oversight or additional oversight and collection of air samples may be performed by the District's ES&A Department as well at their discretion.

In addition to complying with these supplemental specifications, the Contractor must also comply with all other asbestos abatement requirements listed in these asbestos abatement specifications. If Contractors find any conflicting information in the supplemental specifications, the Contractor must comply with the requirements listed herein that are deemed most stringent by the District or District hired asbestos consultant supervising the abatement.

Project Requirements

Contractor shall be approved by the WCSD ES&A Department to perform asbestos abatement activities within the District. **Approval of firms that have not performed activities impacting asbestos for the District previously, will need to submit all necessary documentation outlined in the WCSD ES&A Technical Specifications for the project at least ten (10) business days prior to work commencing for approval.**

All workers certifications – asbestos training and licensing and medical clearance – shall be submitted to the WCSD ES&A at least five (5) working days prior to project commencement at minimum for approval. Contractor is responsible for reviewing WCSD ES&A worker roster for the company to assure all workers to be used on the project have been approved prior to arrival onsite. Workers not identified on the approved worker list for the contractor will not be allowed to perform any activities onsite, even if documentation is provided onsite at time of the project commencement.

The abatement contractor's onsite supervisor shall have a copy of these Specifications onsite at all times and be familiar with the project requirements prior to arrival onsite at the project. Failure to follow requirements of these Specifications, or lack of knowledge of requirements to be followed during the project, are grounds for replacement of the abatement contractor's onsite supervisor.

Only the abatement contractor will be allowed to occupy the project area once abatement activities are scheduled to start. This applies to all WCSD non-ES&A staff/personnel and site staff/personnel. The area shall only be occupied by the abatement contractor, WCSD ES&A staff, and District's independent third-party abatement consultant. Other personnel will not be allowed to occupy the building during asbestos abatement activities.

Contractor shall adhere to the requirements of these Specifications, WCSD ES&A Technical Specifications, Federal, State, and Local regulations.

Water and Electricity

Water and electricity are available onsite, but long hoses and cords may be necessary. The contractor is responsible for any damage to water or power systems caused by their use of those systems.

Contractor shall provide a GFI at the primary plug-in of all electrical trains used for electrical equipment. Hose washers shall be provided at all hose connections to prevent leakage of water and potential damage to District facilities.

Pre-Cleaning

Pre-cleaning of debris may be required during setup and prior to abatement of TSI.

If required, cleanup will be performed once HVAC is shut down and tagged out by the contractor, with District approval, and critical barriers are sealed with 6-mil poly. Workers performing pre-cleaning will use HEPA-vacuums to vacuum debris and dust from the area. Workers will need to wear half-mask respirator fitted with HEPA (P-100) filters and tyvek quality disposable coveralls with attached hood and boots.

Notifications

Contractor is responsible for timely notifications (including courtesy notifications if applicable) to Nevada Division of Industrial Relations and Washoe County Health Department. Notifications shall be filed in advance of any waiting periods in lieu of the proposed project start date or other requirements for pre-work notification. Any revisions to notifications including project scope, start date, duration of project, or any other changes are

the Contractor's responsibility. Valid notifications shall be posted onsite during the project, and copies shall be provided to the District's onsite third-party consultant and ES&A Department.

Equipment

Contractor is responsible for providing all necessary equipment in sufficient quantities to complete the project in the schedule provided for the project. All equipment must arrive onsite clean and in proper functioning order. Any equipment that arrives onsite dirty or not in proper functioning order shall be removed from the project site for cleaning and/or repairs.

Training

Workers performing asbestos abatement activities as part of this project must have AHERA Worker training with at least one worker trained to the AHERA Contractor-Supervisor level. All workers shall be licensed by the Nevada DIR for asbestos work. The crew lead Contractor-Supervisor may not leave the site anytime asbestos abatement operations are being performed.

As noted previously, all workers certifications must be approved by the WCSD ES&A prior to arrival onsite to start work. Copies of the worker certs shall be provided to the District's onsite third-party consultant as well.

Personal Protection Equipment

A tight-fitting powered air-purifying respirator (PAPR) fitted with HEPA filters shall be worn for respiratory protection when performing TSI abatement.

A full facepiece, supplied-air respirator operated in the pressure-demand mode shall be worn by workers performing Class 1 work if the negative exposure assessment, or air sampling performed by ES&A or the District's third-party consultant, indicates that the exposure level will be above 1 f/cc as an 8-hour TWA.

Workers shall wear Tyvek-level disposable coveralls, hard hats, and work gloves. Street clothes may not be worn under disposable coveralls.

All employees shall have a valid medical clearance and fit test for respirators to be used. Medical clearance shall be provided for approval to the WCSD ES&A prior to the project commencement. Copies of the medical clearance and fit test shall be provided to the District's onsite third-party consultant as well.

Personal Air Monitoring

The contractor is responsible for the collection of personal air samples on workers during all abatement activities for asbestos. These samples shall be collected in accordance with OSHA sampling protocols and analyzed by a laboratory with the proper accreditation.

Laboratories to be used for personal air sample analysis must be approved by WCSD ES&A.

Copies of the personal air sampling results, along with laboratory accreditation, shall be submitted to the WCSD ES&A and District's independent third-party consultant.

In addition, the contractor will comply with all requirements regarding personal air monitoring listed in Section 02130, Part 2- - Air Monitoring, 2.02.

Security and Safety

The contractor is responsible for security of all equipment and safety of all employees. Contractor shall provide any storage containers or security needed for tools and equipment if needed.

Contractor is responsible for any ladder, scaffolding, or any other worker safety measures needed to facilitate the TSI abatement as required by state or Federal regulation.

Contractor is responsible for all worker safety and following all applicable regulations, namely Nevada and Federal OSHA.

Occupancy

As noted previously, the project area will be limited to the abatement contractor, WCSD ES&A staff, and District's independent third-party consultant once abatement activities are ready to commence. Once the area has been cleared, other parties may occupy.

Emergency services may also occupy areas in the event of an emergency during the project.

Challenge Testing

All HEPA-filtered equipment to be used on this project shall have been challenge tested (DOP or equivalent) within the previous 30 days prior to use onsite. Copies of the challenge testing results shall be provided to the WCSD ES&A and/or HMS, Inc.

Asbestos Abatement Containment and Abatement Requirements

ALL POLY USED ON PROJECT SHALL BE 6-MIL AND FIRE-RETARDANT UNLESS EXEMPTED IN REQUIREMENTS BELOW.

1. The Contractor shall develop a regulated area that meets the requirements of OSHA regarding posting and limited access.
2. The Contractor shall follow the procedures recommended by the manufacturer of the glovebags, and the specifications required by OSHA regulations.
3. All critical openings within the regulated area shall be sealed prior to set up of the containment using two layers of 6 mil poly.

4. At least one layer of 6 mil poly must be used to contain the abatement area, including ceiling. Two layers of 6 mil poly shall be placed on the floor of the containment. The bottom layer of floor poly must be black to assist with visual clearance.
5. Stationary objects in the immediate area of the room which cannot be removed from the work area must be covered with at least one layer of 6 mil poly sheeting after being pre-cleaned.
6. A minimum three stage decontamination unit with a shower shall be contiguous with the containment. See "Decontamination Chamber Requirements" in this specification for further requirements.
7. Negative pressure shall be established and a recording manometer shall be attached to the containment. Copies of the manometer recordings shall be provided on 8.5"x11" paper by the Contractor.
8. A HEPA-filtered vacuum shall be in the immediate area for use in conjunction with the bags or in case of a spill.
9. Glovebags may not be used on surfaces where temperatures exceed 150 degrees Fahrenheit.
10. Glovebags will be utilized only used inside of a full negative pressure containment.
11. Glovebags may be used only once, and may not be moved or slid for removal of a second section of TSI.
12. At least two persons shall perform glovebag removal.
13. Before beginning the operation, loose and friable material adjacent to the glovebag operation shall be wrapped and sealed in two layers of 6 mil poly sheeting or otherwise rendered intact using encapsulating cloth.
14. The Contractor shall apply a sufficient volume of amended water to wet all pipewrap removed from the pipes while it is enclosed in the glovebag.
15. Prior to placement in the disposal bag, glovebags shall be collapsed by removing air within them using a HEPA-vacuum.
16. Upon detachment, the glovebag must be immediately placed into a 6 mil thick disposal bag. The disposal bags must be sealed using the "gooseneck" sealing technique. Waste bags shall be properly labeled as a regulated asbestos containing waste.
17. Where pipes enter walls, floors, or ceilings which are not within the scope of the project, the pipewrap shall be removed at least 1" into the structure and the pipewrap end must be sealed with bridging encapsulant and/or wettable cloth.
18. The Contractor shall be responsible for ensuring the piping system remains adequately supported at all times. This may be achieved by readjusting existing hanger brackets as insulation is removed, or by other approved methods, such as inserting wood blocks to replace the thickness of the removed insulation.

Decontamination Requirements

A three stage decon unit including a shower is required for asbestos containments. Each chamber of the decon must have self-closing Z-flaps that seal air tight. A four-inch barrier must exist at the floor of each chamber to prevent the transfer of water and debris from chamber to chamber. This barrier will also provide a seal for the flaps between each chamber. Equipment and bag out chambers do not require a shower, but a washing station must exist and they must be three-stages. The washing station must be constructed in a manner that prevents water from splashing or traveling out of the central decon chamber. Equipment and bag out chambers must also have flaps that seal air tight.

Shower units must be equipped with an overflow pan to catch water which overfills the drain system, or is splashed out of the chamber during employee showers. Showers must be supplied with hot water, soap, shampoo, and towels for the workers. Showers shall be sited in the central decon chamber. Showers and washing station must also be equipped with a filtering system that includes a 0.5 micron filter. If filtering system is not available or is not functioning correctly, shower water must be bagged and disposed of as asbestos-containing waste.

All chambers of the decon, including the clean chamber, must be kept clean and dry (except shower) at all times. Abatement work will be stopped if decon is not kept in acceptable condition.

Regulated Area Signage

Asbestos Danger signs shall be posted at all entrances to the containment area, even if the entrance is sealed as a critical barrier. Signs shall also be posted on the flap leading into the shower station of decontamination chambers. Signage will be set once a pre-start visual is passed and work may begin in the containment, but no work will start until all signs are posted.

Signage shall meet the revised requirements set forth in 29 CFR 1926.1101(k)(7).

Air Pressure Differential

Air pressure differential must be established and maintained at -0.05 inches water differential or better before start of abatement and air pressure differential must be maintained through all phases of project, including collection of clearance air samples and receipt of results. A minimum of eight air changes per hour is required for the project. Work will be halted if the air pressure drops below -0.05 inches water differential and can resume when air pressure differential of -0.05 inches is established again.

Air pressure differential must be displayed and recorded on a properly calibrated and fully functioning manometer. Copies of the manometer recording must be provided by the contractor on 8.5" x 11" paper at completion of project.

All negative air machines must be exhausted to the exterior of the building using wire-reinforced flex duct. All negative air machines must be used inside containment. No machines shall be attached to the exterior of the containment with the intake only inside.

Any exterior barricades need to be constructed of a minimum ½" plywood and lockable for security. Contractor is responsible for providing a lock to any exterior barricades, and keys shall be provided to WCSD site facilities coordinator and HMS, Inc. Project Manager.

Make-Up Air Sources

Available, but may need to be HEPA-filtered. Any make-up holes in critical barriers must be equipped with a challenge/DOP-tested HEPA filter. Placing a pre-filter in the make-up air hole will not be allowed.

Disposal Requirements

All asbestos waste generated on this project will need to be double-bagged in 6-mil poly waste bags, or double-wrapped in 6-mil polyethylene sheeting. All waste bags must be sealed in a “gooseneck” fashion. All waste shall be properly labeled and identified for disposal as a regulated asbestos-containing material (RACM).

The contractor will need to provide a lockable waste bin for all waste created on this project. Waste bin will need to be labeled with asbestos signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded.

Waste bins will need to arrive onsite clean of debris or any other waste and in proper functioning order. Waste bins may be rejected by WCSD ES&A staff or District’s independent third-party consultant if these conditions are not met, with no extra charge to the District.

Clearance

Upon completion of asbestos abatement activities, a final visual inspection will be performed by either WCSD ES&A staff or District’s independent third-party consultant. This inspection will be performed only after the abatement contractor crew supervisor has performed their own final visual clearance. Areas must be free of all three-dimensional material with all surfaces clean of dust and debris and all materials abated within the containment area.

Final clearance shall be through aggressive air sampling conducted by the District’s independent third-party consultant. A set of five air samples will be collected inside the containment to be analyzed in accordance with AHERA completion of response action criteria using either phase contrast microscopy (PCM) or transmission electron microscopy (TEM), depending on the quantity of TSI abated.

Clearance criteria for PCM sample analysis, in accordance with AHERA, is 0.01 fibers per cubic centimeter (0.01 f/cc) or less for each of the five samples. Clearance criteria for TEM sample analysis, in accordance with AHERA, is an average of 70 structures per square millimeter (70 s/mm²) or fewer for the inside-containment set of five samples.

Contractor shall return to the site to apply a lock-down encapsulant, remove poly barriers and equipment upon notification of passing clearance air samples.

**Hazardous Materials Specifications
Washoe County School District
Getto Transportation Center – Site Demolition Project**

Site Address

Getto Transportation Center
1850 Kleppe Lane
Sparks, NV 89431

Background

Washoe County School District (WCSD) will be performing a demolition project at their Getto Transportation Center site starting in summer or fall of 2023. This project will include the demolition of all buildings of the site to allow new building construction. The work onsite will involve the handling of various hazardous materials including asbestos-containing materials, lead-containing paints, coatings, and materials, and potentially other hazardous materials that may be discovered during demolition. The potential areas that may contain hazardous materials includes interior and exterior building areas, and potentially underground utilities as they are exposed during the project. This set of specifications is to account for known and potential work to take place during all phases of the project.

Scope of Work

For a general narrative, this project consists of the demolition of the Main Building (A), Bus Wash (B), 200 Building, 300 Building, 400 Building, and storage sheds after the abatement of all asbestos-containing materials is performed in compliance with US EPA NESHAP requirement for the demolition of a regulated structure. There is the potential for buried hazardous materials, such as transite water pipe, to become exposed and required to be removed for construction activities as well.

This project is being conducted for the construction of new site building(s) onsite. This narrative is not a definitive scope of all work to be completed, including hazardous materials work, and is primarily intended to provide a general overview of the project. Project drawings and other construction documents developed shall be consulted to determine exact scope of work.

Within the areas to be demolished, the following hazardous materials were found to exist. However, the removal of materials will be directed by the project drawings and other construction documents.

- Asbestos-containing materials
- **Interior**
 - o Drywall – Knockdown Texture (Main Building – Second Floor Only)
 - o Fire Doors (Main Building)
 - o TSI & Hard Elbows – Fiberglass & Hardpack (Main Building)
 - o Carpet & Mastic – Green Wave Pattern (200 Building)
 - o Vinyl Floor Tile & Mastic – 12” Lt. Blue (200 Building)
 - o Drywall – Stipple & Lt. Knockdown Textures (300 Building)
 - o Drywall – Orange Peel Texture (400 Building)
 - o Black Mastic (400 Building)
 - o Laminate Flooring & Glue (400 Building)

- **Exterior**
 - o Roof Penetration Mastic – White (200 Building & 400 Building)
 - o Transite Panels (200 Building)
- Lead-Based and Lead-Containing Paints – All paints and coatings within the project area of this phase are known to contain detectable concentrations of lead. The only paint found to be lead-free is blue paint on drywall walls in the 200 Building.
- Silica-Containing Materials – Materials within the project area are known to contain silica.

These specifications identify only a general narrative for the scope of work for this phase of work. The contractor is responsible for review of project drawings and construction, along with completion of own measurements, inspection of site conditions, and any other items required to submit their bids and complete the project.

Within these specifications are means and methods for the removal of materials that will be followed on the project for all known work to be completed and additional work that may potentially be required, such as buried transite pipe removal or hidden pipe insulation. As not all potential circumstances or conditions can be anticipated, minimal field adjustment of the means and methods listed within this document may be required. Included within project drawings are documents and/or drawings identifying areas and materials that will require abatement of asbestos.

The general contractor and any sub-contractors working onsite will need to consult the WCSD Environmental, Safety, and Assessment (ES&A) Department's Material Disturbance Permit to verify asbestos and lead content of materials prior to impacting any materials. In addition, Forensic Analytical Consulting Services, Inc. (FACS) has provided a site survey report for the areas inspected as reference, but this document does not take precedence over MDP or project drawings and other construction directives.

Testing of materials not previously sampled or testing to verify asbestos and lead content of materials will only be performed by WCSD ES&A Staff or District's independent third-party consultant. Testing by another third-party consultant will not be accepted as proof of the asbestos-content of building materials or lead-content of paints or coatings.

A lead paint inspection has been performed by Forensic Analytical Consulting Services, Inc. (FACS), which identified lead-based paints or coatings within the project area. Although lead-based paints are present, the work area is not a "child-occupied facility" under the US EPA Renovation, Repair and Painting (RRP) rule and RRP requirements do not need to be met for this project. The contractor must still meet requirements set forth in these specifications, and applicable Federal, State, and local requirements, namely the OSHA Lead in Construction Standard, when handling paints or coatings that do contain lead.

As noted above since nearly all paints and coatings at the site contain lead, the contractor shall be cognizant that not all work disturbing lead may be reflected on drawings. For example, demolition of buildings after asbestos abatement may not be explicitly listed on project drawings as lead work activity.

Many of the materials that may be disturbed as part of the project contain silica. The contractor is responsible for complying with the requirements of 29 CFR 1926.1153 – OSHA's Crystalline Silica Standard for Construction. Proof of compliance with the Standard shall be provided by contractors at the District or independent third-party request.

Project Requirements

All asbestos-containing materials must be abated from the buildings planned for demolition prior to the demolition of the structure commencing. This includes materials that may be non-friable or less than 1% asbestos. In addition, lead-glazed ceramic wall tiles must be removed prior to demolition by the abatement contractor.

Prior to demolition of any of the planned buildings, the contractor shall ensure that loose and peeling paints have been stabilized at interior and exterior areas. The requirement to stabilize paints is to ensure that more paint chip debris is not created by demolition activities than necessary. Conditions may change between the issuance of these specifications and submittal of bids (lead-containing paints may deteriorate further) and the contractor is responsible for assessing the amount of paint to be stabilized for inclusion into their bid. The stabilization of paints may be handled by either a lead remediation contractor acting as a sub-contractor, or by any other trade that may meet the requirements of these specifications and WCSD requirements for lead work activities.

Removal of components containing lead in their entirety is not required prior to demolition with the exception of ceramic tiles as noted, but a contractor may opt to remove them as part of their waste disposal strategy to limit the potential for waste characterization to deem the entire waste stream as hazardous for lead. If the contractor chooses to remove these components, removal shall conform to the lead requirements set out by the District's ES&A Department or District's Consultant.

Contractor shall be approved by the WCSD ES&A Department to perform asbestos and lead activities within the District. **Firms which have not previously performed activities impacting asbestos or lead for the District will need to submit for approval all necessary documentation outlined in the WCSD ES&A Technical Specifications for the project at least fifteen (15) business days prior to work commencing.** The approval of firms includes contractors that will be performing work impacting lead-containing paints, even if that firm is not primarily a lead remediation contractor.

All worker asbestos and lead training certifications shall be submitted for approval to the WCSD ES&A Department at least fifteen (15) working days prior to project commencement at minimum. Online training of employees is not sufficient to meet the requirements of District policies and all training must be provided in-person with each individual receiving a training certificate from the training provider.

Contractor is responsible for reviewing WCSD ES&A worker roster for the company to ensure that all workers to be used on the project have been approved prior to arrival onsite. Workers not identified on the approved WCSD ES&A worker list for the contractor will not be allowed to perform any activities onsite, even if documentation is provided onsite at time of the project commencement or work. This applies to any personnel impacting lead-containing surfaces, even if not primarily a lead remediation contractor.

The contractor performing work on this project will be responsible for following all plan requirements to complete the project. Neither WCSD personnel, nor any independent consultant providing project oversight, will be responsible for identifying materials or components as part of this contract. Contractor's onsite supervisor(s) shall have a copy of these Specifications on site at all times and shall be familiar with the project requirements prior to arrival on site for the project. Failure to follow requirements of these Specifications, or lack of knowledge of requirements to be followed during the project are grounds for replacement of contractor's onsite supervisor.

Although it is planned that the site will be completely vacated prior to the start of the project, it must still be noted that no work impacting hazardous materials shall be performed when staff are present within buildings or in adjacent exterior areas of the site. In addition, barriers will be in place as needed to separate asbestos

abatement from other non-abatement trades that may be working on site. The construction of these barriers will typically be air-tight and constructed of wood or drywall over wood or metal framing as desired by contractor.

Only the hazardous materials contractor will be allowed to occupy the designated work area once asbestos and lead activities are scheduled to start. This applies to all WCSD non-ES&A staff/personnel, general contractor, and other sub-contractors. The designated work area shall only be occupied by the hazardous materials contractor, WCSD ES&A staff, and District's independent third-party abatement consultant.

Contractor shall adhere to the requirements of these Specifications, WCSD ES&A Technical Specifications, Material Disturbance Permit, Lead Appendix (found in Material Disturbance Permit), and Federal, State, and Local regulations.

Water, HVAC, and Electricity

Water and electricity are available onsite currently; however, long hoses and cords may be necessary. Contractor shall provide a GFCI at the primary plug-in of all electrical trains used for electrical equipment. Hose washers shall be provided at all connections to prevent leakage of water and potential damage to District facilities. Contractor is responsible for any damage caused by their usage to any District water or electrical systems.

Over the course of the demolition process, it may become necessary to provide an additional water source, such as a water truck, to provide enough water control to prevent visible emissions.

Since wall and ceiling areas containing electrical circuits will be removed, temporary power shall be setup as needed by a licensed electrician provided by the general contractor within the work areas. All power to lights, switches, wall outlets, etc. shall be de-energized prior to removal of any materials in a work area. Contractor shall provide all necessary spider boxes and pig-tails to install temporary power.

Contractor shall coordinate with the WCSD Project Manager for the shut-down of all HVAC systems within the project area prior to commencing setup for demolition and removal activities. Contractor is responsible for the lock-out / tag-out of all electrical circuits and HVAC systems that may be impacted by the project. Contractor shall follow requirements of WCSD for the lock-out / tag-out of equipment.

Pre-Cleaning

No pre-cleaning of asbestos or lead contamination at interior areas is required to complete this project; however, small amounts of garbage and build-up of dust may be required to be cleaned to allow sufficient adherence of containment barriers.

For exterior stabilization of paints, contractor is responsible for cleanup of any paint debris on the soil around the buildings as applicable. This debris shall be cleaned from the soil/ground and a visual inspection performed prior to installation of any drop sheets for stabilization of remaining paints.

Notifications

The selected contractor is responsible for filing notification to the Washoe County Health District for the abatement of asbestos-containing materials. This includes notifying for the removal of drywall and TSI as regulated (friable) asbestos-containing materials as necessary to comply with regulations. Contractor shall also notify Nevada OSHA for the abatement of asbestos-containing materials on this project. These notifications shall be made at least 10 working days prior to abatement commencing onsite, including any containment setup. Contractor is responsible for the payment of any fees associated with asbestos abatement notifications.

In addition to the asbestos abatement notifications, the planned demolition of multiple buildings will require a notification to be filed with the WCHD. Prior to demolition activities commencing, the asbestos survey report for the structure shall be filed with the Washoe County Health District (WCHD) and an Acknowledgement of Asbestos Assessment (AAA) Form shall be received to be filed for any necessary permits from the City of Reno. If the AAA Form cannot be obtained due to a conflict in the survey report, the contractor shall notify FACS. It is recommended the AAA Form be obtained as soon after Notice to Proceed is issued to limit any potential delays in project schedule. The requirement for the contractor to obtain the AAA Form may be modified by other construction documents.

At least 10 working days prior to demolition commencing, the contractor shall ensure that they hold the necessary demolition permit from the WCHD for compliance with the US EPA National Emissions Standard for Hazardous Air Pollutants (NESHAP) regulation. A copy of the permit and a copy of proof of receipt of fees paid for the permit shall be provided to the WCSD Project Manager and Consultant prior to any demolition activities commencing. A copy of the permit shall be kept onsite during any demolition activities.

Additional requirements for a dust permit, storm water, and other construction permitting may be required to complete this project. The contractor shall review all construction documents and be familiar with applicable local, State, and Federal regulations regarding demolitions to ensure compliance.

Contractor(s) shall provide a copy of all notifications to the District's independent third-party consultant and have a copy posted onsite.

Equipment

Contractor is responsible for providing all necessary equipment in sufficient quantities to complete the work in the schedule provided for the project. All equipment must arrive onsite clean and in proper functioning order. Any equipment that arrives onsite dirty or not in proper functioning order shall be removed from the project site for cleaning and/or repairs.

The requirement for clean equipment in proper working order extends to any rental equipment used on the project. If rental equipment is used, contractor shall provide notification in writing to the rental agency that equipment will be used within an asbestos or lead regulated work area. Proof of this notification being filed shall be provided to District's independent third-party consultant.

Operators of lifts or other similar powered equipment must be trained in the use of equipment to meet manufacturer and OSHA requirements. Proof of training shall be provided if requested to WCSD and District's third-party consultant.

Training

Workers disturbing asbestos-containing materials must have AHERA Worker training. One worker on the abatement work crew must be trained to the AHERA Contractor-Supervisor level.

Workers performing tasks impacting lead paints or coatings, regardless of level of lead present, must have OSHA Lead Action Level training. This requirement extends to any contractor and their personnel performing the demolition of structures with lead-containing or lead-based paints or coatings.

As noted previously, all workers certifications must be approved by the WCSD ES&A prior to arrival onsite to start work. Certifications shall clearly identify the name/level of the training and provide the complete name of the worker. Names on certifications must match from certification to certification. Failure to meet these requirements may cause a delay in approval up to complete rejection of certifications until corrections can be made and new copies obtained by the contractor.

Copies of the worker certs will also be requested to be provided to the District's onsite third-party consultant as well. Web-based or online training is prohibited by District policy, unless modified by other contract documents.

As this project may take place over a long period of time, contractors are responsible for continuing to ensure worker roster is up to date with staff certifications. Certifications cannot be approved onsite by the District's independent third-party consultant.

Personal Protection Equipment

All personnel entering a regulated area (both asbestos and lead), regardless of level of work to be performed, shall wear disposable coveralls, tight-fitting half-face, negative-pressure respirators fitted with HEPA (P-100) filters, hard hats and safety glasses at minimum. Additional PPE requirements, based on materials and locations of work are provided below.

Street clothes may not be worn beneath disposable coveralls at interior asbestos abatement regulated work areas. Street clothes may be worn beneath disposable coveralls for exterior asbestos abatement and lead activities, but street clothes will be HEPA-vacuumed clean if coveralls are torn or ripped. Requirements of PPE extend to any contractors disturbing hazardous materials, even if they are not primarily a remediation contractor.

All employees shall have a valid medical clearance and fit test for the respirators to be worn. Copies of the medical clearance and fit test must be provided to the District's onsite independent third-party consultant.

Drywall & TSI Abatement – Workers shall start the project wearing full facepiece powered air purifying respirators fitted with HEPA (P-100) filters. At least two batteries shall be provided for each PAPR onsite to allow one battery to charge while the respirator is being worn. Contractor – Supervisor shall record the measured flow rate of PAPRs as they are donned to ensure a sufficient pressure exists in accordance with manufacturer guidelines.

Contractor may reduce respiratory protection down to tight-fitting negative-pressure air purifying half-mask respirators fitted with HEPA (P-100) filters if personal air monitoring results shows exposures are below 0.01 fibers/cc as an 8-hour time weighted average for three consecutive shifts.

Mastic Abatement – Workers shall wear rubber boots, and stacked filters with organic vapor and HEPA cartridges shall be fitted to respirators.

Exterior & Roofing Abatement – Contractor is responsible for providing sufficient fall-protection safety equipment in locations and amounts required by OSHA for employees. This includes any necessary tie-offs, lanyards, harnesses, etc. Contractor is also responsible for ensuring there is sufficient equipment for use by consultant or other regulatory inspectors that may be required to use to access areas.

For personnel operating heavy equipment to demolish structures, workers are approved to wear standard construction garb and do not require respiratory protection if all aspects of this specification are met and if the contractor provides an initial exposure assessment stating work is not anticipated to expose workers above the OSHA Lead Action Level or PEL. If personnel performing demolition must enter a regulated area, or an initial exposure assessment is not provided, they shall wear all required PPE for a regulated area as referenced above.

The contractor may opt to include additional PPE items based on their own job hazard assessment for the project, but they may not reduce level/type of PPE below what is required in this Specification.

Personal Air Monitoring

The contractor is responsible for the collection of personal air samples on 50% of workers entering a regulated work area during asbestos abatement and lead disturbance activities as applicable. If an odd number of workers are entering the regulated work area, the contractor shall round up for the number of workers to be monitored (i.e., five workers entering a work area would require collection of three samples). These samples shall be collected in accordance with OSHA sampling protocols and analyzed by a laboratory with the proper accreditation and approval from the WCSD ES&A Department.

The contractor shall have their laboratory submit or fax within **48 hours** of the date the sample was taken the final laboratory result documents (including legible chain of custody) for air monitoring to the WCSD ES&A Department. No hand-written results reports will be allowed. The laboratory reports will reference the air monitoring cassette's factory assigned number and the personal air monitoring results must be properly applied to an 8-hour time weighted average. Failure to submit results within the required 72-hour period (48-hour turnaround with 24-hour grace period) may result in the District temporarily stopping the applicable remediation project until results are received. Continued failure may also result in the termination of the contract.

The District's independent third-party consultant reserves the right to halt work or increase respiratory protection in the event that personal air samples are not turned in timely, or if area air sampling shows current respiratory protection does not sufficiently protect employees.

Security and Safety

The contractor is responsible for security of all equipment and safety of all employees. Contractor shall provide any storage containers or security needed for tools and equipment if they are to be left onsite. Contractor shall coordinate with WCSD for the placement of any storage bins.

Contractor is responsible for security of the building at locations that have components removed before replacement (for example, after removal of wall-mounted louvers, doors, windows, etc.) or components removed to create openings for the exhaust of negative air machines. In addition, contractor is responsible for enclosing any decontamination chambers sited at exterior areas of a structure in plywood. Security measurements must meet the approval of general contractor and WCSD.

Contractor is responsible for all worker safety and following all applicable regulations, namely Nevada and Federal OSHA.

Occupancy

As noted previously, the immediate project area will be limited to the hazardous materials contractors, WCSD ES&A staff, and District's independent third-party consultant once abatement and remediation activities are ready to commence. Once the area has been cleared, other parties may occupy.

For exterior asbestos abatement, no unauthorized personnel shall be within 100 feet of the work area. For exterior lead remediation activities, no unauthorized personnel shall be within 50 feet of the work area.

Emergency services may also occupy areas in the event of an emergency during the project.

Challenge Testing

All HEPA-filtered equipment to be used on this project shall be challenge tested (DOP or equivalent) at the project site prior to use. If the project extends over multiple mobilizations, the HEPA-filtered equipment shall be tested prior to use for each mobilization. Copies of the challenge testing results shall be provided to the WCSD ES&A and/or District's independent third-party consultant.

No HEPA-filtered equipment will be allowed to remain onsite after a contractor demobilizes from the site or stored onsite when the contractor cannot guarantee security of the equipment.

Air Pressure Differential Requirements

All interior containment areas shall be placed under negative air pressure. An air pressure differential of -0.050" WC must be established and maintained through all abatement or remediation activities until clearance sample results are received. The air pressure differential shall be displayed and recorded by a properly functioning manometer at each negative pressure enclosure location. Failure to have a properly recording manometer will require the Contractor-Supervisor to record the air pressure differential by hand at 10-minute intervals, including recording of any pressure differential loss and re-establishment of sufficient air pressure differential until a properly operating manometer is provided.

The manometer display shall have the correct date and time for the data being recorded and this requirement extends to any handwritten data. Copies of the air pressure differential readings shall be provided to the ES&A Department and District's independent third-party consultant.

Asbestos and Lead Abatement Containment & Handling Requirements

The following specification sections have been developed to best capture all containment requirements to allow the contractor to submit a reasonable bid. However, it can be expected that some modifications to the requirements below will need to be made to fit specific space conditions, allow a safer or more-efficient abatement to be completed and as required to meet changing project schedule as work progresses onsite.

All poly used on this project shall be 6-mil in thickness and fire-retardant, unless exempted below. All containment areas must have a fire extinguisher within the containment, at the entry / exit to containment area, and within the containment area as required by OSHA. No work shall take place until these extinguishers are in place.

Anticipated abatement at the interior of buildings scheduled for demolition includes removal of drywall, thermal system insulation (TSI), fire doors, floor tiles and sheet flooring with associated mastics, carpet and mastic, and lead-coated ceramic tiles.

Asbestos and lead removal activities shall be completed within the same containment areas whenever possible to limit containment construction time and delays for the collection and analysis of clearance samples. The following specifications are designed for interior work to proceed with ceiling, wall, and miscellaneous materials abatement and remediation occurring prior to that of flooring materials. The remediation contractor may request to make modifications to containment areas in writing, but any modification must be approved by the District's AHERA Project Designer in writing before implementation.

Anticipated abatement at the exterior of buildings scheduled for demolition includes removal of transite panels and roofing mastics.

When planning for exterior asbestos abatement or lead paint stabilization, contractors shall be cognizant of any inclement weather that may prevent work from commencing or requiring work to be halted. This includes heavy wind gusts (more than 25 mph or more than two gusts of 35 miles per hour in 20 minutes) and summer thunderstorms in the afternoons. Weather conditions that allow asbestos debris or lead paint debris to run off or blow out of containment area will be grounds for halting of work.

Interior Containment Requirements

1. Any loose equipment, furnishings, or supplies shall be removed by District and general contractor (or other sub-contractor) prior to any containment construction activities commencing. Other construction contract documents may modify or identify the exact party responsible for movement and salvage of items that will not disturb hazardous materials.
2. Critical barriers shall be erected at all openings within the work area and shall be sealed with two layers of 6-mil poly. This includes doors, vents, operable windows, etc.
3. Any poly walls installed at areas to act as walls of a containment must be two layers of 6-mil poly and sufficiently secured to prevent a breach in containment during the abatement process.
4. One layer of 6-mil poly shall cover the work area floor if flooring is asbestos-containing. If flooring is not asbestos, two layers of 6-mil poly shall be installed to prevent contamination of flooring materials.
5. Poly drop sheets shall be secured to prevent billowing and creation of a trip hazard or movement of drop sheets.
6. Poly seams shall be staggered at least 4" to prevent debris from falling below the poly drop sheet or wall poly seams.
7. Wall surfaces and other immovable objects that may not be required to be removed within containment areas shall be covered with one layer of 6-mil poly.
8. All interior work shall be completed within a negative pressure enclosure. The contractor shall provide sufficient negative air machines to generate an air pressure differential of at least -0.050" WC within the work area when compared to adjacent areas.
9. All negative air machines shall be exhausted to the exterior of the structure using wire-reinforced flex ducting. All negative air machines shall be installed within the containment; installation of the face of the machine into poly walls or barriers is not allowed.
10. Work cannot start until air pressure differential of -0.05" WC or greater has been established and must be maintained through all phases of the abatement project. As noted above, air pressure differential shall be displayed on a fully-functioning recording manometer.

11. A viewport shall be placed on the poly walls or at site windows, as allowable, to allow viewing of work area for inspectors. Placement of view ports must be approved, and may be directed by, District's ES&A Department or District's independent third-party consultant.
12. A three-stage decontamination chamber system shall be attached to each negative pressure enclosure. The requirements for this system are detailed below.
13. All poly barriers that may allow access into a regulated area shall have signs installed at clearly visible locations to prevent tampering or breaching of containment areas. These barriers may be at doorways, free-standing poly walls, or similar locations. In addition, signs shall be posted on the flap leading from the "clean" chamber into the shower of the decontamination system.
14. Signs shall meet requirements set forth in 1926.1101(k)(7) for an asbestos regulated area, and 1926.62(m) for a lead regulated area, including the use of protective clothing and respiratory protection. Signs shall be posted once the containment area has been approved, but before any abatement begins.

Interior Abatement Requirements

1. All materials shall be removed as intact as possible using hand tools to the greatest extent possible.
2. Materials to be disturbed shall be wetted prior to and during disturbance with amended water to limit the creation of visible emissions.
3. A build-up of waste or debris within the work area is prohibited. Contractor workers shall ensure the area is kept free of a build-up of unpackaged waste, waste bags, consumed supplies or packaging, or other debris as work progresses to prevent the crushing of debris into a finer dust, generation of visible emissions from dried out material, and accidents within the work area.
4. Drywall shall be removed down to the framing of ceilings and walls. Materials shall be removed using hand tools only – use of ride-on equipment to demolish these materials is prohibited.
5. Screws or nails used to attach the materials to the building framing shall be removed within the containment area as part of detail cleaning. Any joint compound or texture overspray on framing within the work area shall be cleaned from framing. Detail cleaning of texture and joint compound from surfaces shall be completed using hand tools only.
6. Asbestos-containing fire doors shall be removed within the same containment areas as drywall abatement.
7. All thermal system insulation (TSI) hard elbows or pipe wrap shall be abated using the glovebag method or wrap and cut method, as applicable. Because of the height of asbestos-containing TSI materials, open abatement of materials will not be allowed on this project.
8. Glovebags may not be used on surfaces where temperatures exceed 150 degrees Fahrenheit.
9. Glovebags may be used only once and may not be moved or slid for removal of a second section of TSI.
10. The Contractor shall apply a sufficient volume of amended water to wet all pipe wrap removed from the pipes while it is enclosed in the glovebag.
11. All pipe material shall be removed from the piping to remain in place. This includes material that has become embedded into any pipe threading, elbows, etc. Contractor shall be prepared with wire brushes to clean surfaces of all material down to bare metal.
12. Prior to placement in the disposal bag, glovebags shall be collapsed by removing air within them using a HEPA-vacuum.
13. Upon detachment, the glovebag must be immediately placed into a 6-mil thick disposal bag. The disposal bags must be sealed using the "gooseneck" sealing technique. Waste bags shall be properly labeled as a regulated asbestos containing waste.
14. If the abatement contractor uses the "cut and wrap" method to remove abandoned pipes and pipe wrap, they shall abate an area of at least 1 foot in length using the glovebag methods described above to allow cutting equipment to operate without impacting adjacent pipe insulation materials.

15. Prior to cutting of insulated pipe runs, pipe insulation shall be completely wrapped in two separate layers of 6-mil poly and sealed as a leak-tight container.
16. Once the pipe materials are cut, they must be lowered to the ground by workers. No pipe sections will be allowed to fall to the floor of the space when cut.
17. Cut sections of piping that are not immediately removed from the containment area shall be stored in a designated area of the containment and secured to prevent from rolling or becoming a trip hazard to workers moving about the containment. All sections of piping must be removed from the containment prior to work stoppage or end of shift as applicable.
18. Where pipes enter walls, floors, or ceilings which are not within the scope of the project, the pipe wrap shall be removed at least 1" into the structure and the exposed pipe wrap end must be sealed with bridging encapsulant and/or wettable cloth.
19. No TSI shall remain unsealed at the conclusion of a shift to prevent the release of debris into the containment.
20. The Contractor shall be responsible for ensuring the piping system remains adequately supported at all times. This may be achieved by readjusting existing hanger brackets as insulation is removed, or by other approved methods, such as inserting wood blocks to replace the thickness of the removed insulation.
21. Floor tiles shall be removed as intact as possible using hand tools.
22. Contractor may opt to use a standard buffer and mastic solvent or hydro-blasting of floor surfaces to remove mastic.
23. If a buffer shall be used for the abatement of mastic from the floor surface, workers shall assure that an overabundance of mastic solvent is not used that may escape the containment area or run below fixed cabinetry.
24. The mastic of the floor must be abated to the point of no three-dimensional material. Contractor will be required to chase mastic into cracks or divots of the substrate.
25. Solvent used for removal shall be low-odor and approved to not damage any new floor materials to be installed after abatement.
26. Flooring mastic must be abated to the point of no three-dimensional material on the substrate. Contractor will be required to chase mastic into cracks or divots of the substrate.

Interior General Waste Packaging Requirements

1. No "loose" water shall be present in waste bags at the conclusion of packaging. Water shall be soaked up with either kitty litter or diatomaceous earth as necessary to meet this requirement.
2. A HEPA-vacuum shall be used to evacuate air from waste bags when sealing. Workers using hands or knees to collapse air out of waste bags is prohibited.
3. Waste shall be placed into 6-mil poly waste bags. All waste bags shall be sealed in a "gooseneck" fashion to create a leak-tight container.
4. Waste shall be properly labeled for disposal as either a non-hazardous asbestos containing waste (OSHA labeling) or regulated asbestos-containing material (EPA and OSHA labeling) prior to removal from the containment area.
5. Contractor may opt to construct load-out chambers for waste. These chambers shall be no less than two-chambers based on materials being removed and work activities taking place within the containment area. Additional requirements for load-out chambers are located in the decontamination chamber section below.
6. Waste transport containers, such as rolling carts, shall be lined with one layer of 6-mil poly prior to use for waste transportation.
7. Additional waste requirements are identified in the waste disposable section below.

Interior Containment Cleaning Requirements

1. At the conclusion of asbestos and lead abatement, the remaining surfaces of the work area shall be wet-wiped and HEPA-vacuumed clean of all debris and dust. Cleaning shall take place from ceiling down to the floor area.
2. Use of any form of compressed air or tools such as leaf-blowers is prohibited.
3. As part of the detail cleaning, the top layer of poly, i.e., at floor areas not removed as part of abatement activities, may be removed.
4. During final cleaning, contractor workers shall start from the area furthest from entry/exit point and work their way back to the entry/exit to the containment area.
5. Containment poly is included in description of asbestos waste and must be packaged as noted above.
6. A final visual inspection can only be requested after all cleaning has been completed, all waste has been packaged and removed from the containment area, and the remediation contractor's onsite supervisor has performed their own visual inspection.

Exterior Abatement – Roofing Mastic & Transite Panels

1. All openings leading into interior spaces shall be sealed with one layer of 6-mil poly as critical barriers within a 100-foot diameter around the work area. This includes doorways, windows, louvers, HVACs, etc. Critical barriers shall also be installed at adjacent buildings within the 100-foot diameter. The barriers may remain in place past one shift if approved by WCSD but shall be cleaned if within regulated area during the work shift.
2. Poly sheeting shall be placed at ground surfaces if abatement is to take place within 10 feet of the roof edge. Poly shall extend out 10 feet from the building to capture any material that may fall from the roof area.
3. Ground poly shall be secured or weighed down to prevent billowing and movement of poly drop sheet or creation of a trip hazard.
4. The Contractor shall limit and control exterior access within 100 feet of exterior work areas. This will require the erection of barrier tape with Contractor-supplied pylons or fixed objects as available around the project area.
5. A HEPA-vacuum shall be present inside the regulated area prior to abatement activities commencing.
6. The regulated area shall be demarcated using asbestos danger tape and/or signage. This barrier shall extend out around the work area at least 50 feet unless modified onsite by the District's independent third-party consultant.
7. A wash station / decontamination area shall be attached to the containment area to allow workers to decontaminate themselves and equipment when exiting the work area. This wash station shall include wet-wipes, soap, and towels for use with a waste bag for disposal of PPE and decontamination waste materials.
8. Materials shall be removed as intact as possible using non-mechanical means. It is anticipated that non-asbestos roof materials will be cut around and mastic removed substantially intact, and some areas scraped clean of mastic residue (metal components to remain or be salvaged).
9. Mastics and sealants shall be removed down to the substrate and no three-dimensional material may remain at conclusion of abatement.
10. Materials shall be wetted using a Hudson sprayer applying amended water to the materials prior to, and during, abatement.
11. All surfaces (including poly) shall be wet-wiped and HEPA-vacuumed clean as part of the detail cleaning within the work area.

12. No “loose” water shall be present in the waste bag when it is removed from the containment area. Water shall be soaked up with either kitty litter, diatomaceous earth or similar as necessary to meet this requirement.
13. All waste shall be bagged prior to any work stoppages. This includes breaks, such as lunch, as well as end of day stoppages.
14. All waste shall be double-bagged in clear 6-mil poly waste bags and bags shall be sealed in a “goose-neck” fashion to create a leak-tight container.
15. A HEPA-vacuum shall be used to evacuate air from waste bags when sealing.
16. All waste shall be packaged for disposal on the roof then lowered to the ground by hand or via a lift. No waste or waste bags may be dropped from the roof to the ground or to an open-top waste container.
17. After final cleaning, the Contractor’s supervisor shall perform a visual inspection to determine if the work area is ready for a visual clearance inspection, and the supervisor shall notify District ES&A personnel or District’s independent third-party consultant when the work area is ready.
18. A visual clearance inspection will be performed by the District’s ES&A personnel or District’s independent third-party consultant. The criteria for passing visual clearance shall be the abatement of asbestos-containing material and the absence of any dust or debris within the regulated work area. All waste and debris shall be properly packaged and removed from the regulated area prior to this final inspection.

Exterior Abatement – Transite Panels

1. All openings leading into interior spaces shall be sealed with one layer of 6-mil poly as critical barriers. This includes doorways, windows, HVAC registers, etc. Critical barriers from other hazardous materials work activities that may be remaining in place can be used as critical barriers for this work.
2. Poly shall be installed at interior side of panel if interior finish had been removed prior to abatement. This poly shall extend beyond the panel if needed to create a leak-tight seal.
3. Poly sheeting shall be placed at ground surfaces and extend out at least 10 feet in each direction from work area on exterior side of the building.
4. Ground poly shall be secured or weighed down to prevent billowing and movement of poly drop sheet or creation of a trip hazard.
5. A HEPA-vacuum shall be present inside the containment area prior to abatement activities commencing.
6. Signs and/or barrier tape to establish the regulated area shall meet requirements set forth in 1926.1101(k)(7) for an asbestos regulated area, including the use of protective clothing and respiratory protection. Signs shall be posted once the containment area has been approved, but before any abatement begins. Personal Protection Equipment must be worn within this regulated area.
7. A 6-mil poly drop sheet shall be attached to the regulated area to act as a decontamination area for exterior abatement. This area shall include soap, towels, and water with a waste bag for disposal of PPE and decontamination waste materials as removed from the regulated area.
8. Materials shall be removed as intact as possible using non-mechanical means. Any sealants found between the panel and building opening to remain shall be scraped clean and handled as asbestos-containing.
9. Materials shall be wetted using an airless or Hudson sprayer applying amended water to the materials prior to, and during, removal.
10. All surfaces (including poly) shall be wet-wiped and HEPA-vacuumed clean as part of the detail cleaning.
11. No “loose” water shall be present in the bag when it is removed from the containment area. Water shall be soaked up with either kitty litter, diatomaceous earth or similar as necessary to meet this requirement.
12. All waste shall be bagged prior to any work stoppages. This includes breaks, such as lunch, as well as end of day stoppages.

13. All waste shall be double-bagged in clear 6-mil poly waste bags and bags shall be sealed in a “goose-neck” fashion. Waste may also be wrapped in two separate layers of 6-mil poly and sealed in a leak-tight fashion.
14. A HEPA-vacuum shall be used to evacuate air from waste bags when sealing.
15. Containment poly is included in description of asbestos waste and must be packaged as noted above.
16. Poly shall be cleaned of all debris as part of final detail cleaning. Folding poly up without cleaning and prior to receiving a visual clearance is prohibited.

Transite Pipe Abatement

If buried sections of transite pipe are discovered onsite during the demolition process, the following abatement procedures would apply during the removal process.

1. The transite pipe material may be excavated to allow access by non-asbestos trained personnel; however, if transite pipe debris is discovered, excavation shall be halted to allow cleanup of material.
2. Contractor shall ensure the excavated area is shored as required to meet OSHA standards.
3. Excavated area shall be large enough to allow two workers to be in the trench area at the same time during abatement.
4. Once the pipe has been excavated, asbestos workers and supervisor shall conduct the setup of containment area.
5. One layer of 6-mil poly shall be placed over soil surfaces below and adjacent to the pipe to capture any debris generated.
6. Contractor will be required to provide pylon or similar component to allow barrier tape to be installed around the work area. This barrier tape shall be caution tape extending out 50 feet from the work area and the regulated work area shall extend out 15 feet in each direction from work.
7. Signs and/or barrier tape to establish the regulated area shall meet requirements set forth in 1926.1101(k)(7) for an asbestos regulated area, including the use of protective clothing and respiratory protection. Signs shall be posted once the containment area has been approved, but before any abatement begins.
8. A HEPA-vacuum and Hudson-type sprayer filled with amended water shall be in the work area for use.
9. The transite pipe shall be snap-cut for removal. Workers using the snap-cut tool shall be trained in the proper use of the tool to ensure the pipe is not crushed.
10. The area of cut shall be wetted with amended water prior to, and as work is conducted, to limit the release of asbestos fibers.
11. Transite pipe waste shall be cut in manageable sections. Transite pipe waste shall be wrapped in two separate layers of 6-mil poly and sealed in a leak-tight fashion.
12. If transite pipe is structurally sound and can be supported, it may be lifted out of the trench area by use of a backhoe. Pipe must be wrapped in poly prior to lifting out of the trench.
13. Work area shall be cleaned of all debris from pipe materials. This may require cleaning of poly drop sheets or bagging of contaminated soil. Any bagged waste shall be placed in two 6-mil poly waste bags.
14. All waste, non-essential supplies, and equipment shall be removed from the work area prior to a final visual inspection. To pass a final visual inspection, all transite pipe shall be removed as directed and the work area must be clean of all dust and debris.

Exterior Lead Paint Stabilization

1. Critical barriers shall be erected at openings within the work area and extending out at least 20 feet from work area. Critical barriers from other hazardous materials work activities that may be remaining in place

can be used as critical barriers for this work. The openings to be sealed as critical barriers shall be sealed with one layer of 6-mil poly. This includes doors, vents, windows, etc.

2. One layer of 6-mil poly shall cover the ground at exterior work areas, extending at least 10 feet in each direction from the site of lead disturbance. This containment area may be increased if debris cannot be contained to the poly drop sheets. Fixed objects within this containment area shall be covered as well.
3. Poly drop sheets shall be secured to prevent billowing and creation of a trip hazard, and to prevent movement of drop sheets.
4. A wash station / decontamination area shall be attached to the containment area to allow workers to decontaminate themselves and equipment when exiting area. This wash station shall include water, soap, and towels for use with a waste bag for disposal of PPE and decontamination waste materials.
5. Lead hazard tape or caution tape with lead hazard signage shall be placed at the perimeter of the work area to create a regulated work area. Personal Protection Equipment must be worn within this regulated area.
6. Disturbance to painted or coated components or materials shall be performed using hand tools.
7. Painted or coated components or materials to be disturbed shall be wetted prior to and during removal to limit the creation of dust.
8. Painted surfaces shall be stabilized back to the point of being tight to the substrate.
9. A build-up of waste or debris within the work area is prohibited. Contractor workers shall ensure that the area is kept free of waste bags, paint chips, or other debris as work progresses to prevent the crushing of lead debris into finer lead dust.
10. Waste shall be placed into 6-mil poly waste bags. All waste must be double-bagged with both waste bags sealed in a "gooseneck" fashion to create a double-layered leak-tight container.
11. No "loose" water shall be present in the waste bags at the conclusion of lead disturbance. Water shall be soaked up with either kitty litter or diatomaceous earth as necessary to meet this requirement.
12. A HEPA-vacuum shall be used to evacuate air from waste bags when sealing. Workers using hands or knees to collapse air out of waste bags is prohibited.
13. At the conclusion of lead disturbance, the poly drop sheets shall be wet-wiped and HEPA-vacuumed clean of all debris and dust.
14. The contractor shall apply an encapsulating primer to the painted edges, or over surfaces, to seal the edges of stabilized areas and prevent further delamination of paints.

Building/Structure Demolition Note

Removal of lead-containing components in their entirety is not required to be completed for this project. If the contractor elects to remove such items prior to demolition of the structure to simplify waste profiling and disposal, the contractor should expect that containment and removal requirements will be similar to the requirements noted above.

If any components with lead-containing paint are left in place for demolition, the contractor performing the structure demolition will need to provide workers with OSHA lead training in compliance with these specifications. At the conclusion of demolition and loading of debris into waste bins for movement off-site, the contractor is responsible for leaving a clean work site behind. One of the keys to this clean work site criteria will be the HEPA-vacuum cleanup of **all** paint chip debris generated during the demolition of the building or structure.

To comply with NESHAP regulation, no visible emissions can be generated during remediation or demolition and materials cannot be tracked out of work area. Track out includes soil or debris on tires, failure of waste bins allowing debris to escape, and water running out of the work area.

Lead Hazard signs are not required for the demolition of the structure, but the contractor shall provide caution tape, or similar, to isolate work area from other portions of the site if requested by the WCSD Project Manager or Consultant.

Decontamination Requirements

No consumption of food or fluids shall take place in the decontamination or load-out systems. Workers that wish to consume food or fluid shall fully exit the containment and decontamination system, including the doffing of all contaminated PPE. Workers that fail to meet this requirement and remove PPE within a regulated area will be immediately removed from the project.

A three-stage decontamination chamber for worker ingress/egress shall be attached to all negative pressure enclosures. One system shall be required for every 10 workers that may be working within a containment area (i.e., 10 workers = 1 system, 11 workers = 2 systems). This chamber system shall consist of a dirty chamber, a shower, and a clean chamber. The decon chambers shall be constructed of 6-mil poly and each chamber shall be at least 3'L x 3'W x 7'H. A curb of at least 4" shall exist between each chamber to prevent the movement of debris or material from chamber to chamber. Each chamber shall be separated with a Z-flap that will seal closed in the event of a power outage.

The water in the shower shall be supplied by a properly functioning shower head. Both hot and cold water must be available and water temperature shall be controllable by workers using the shower. A splash pan may be required if workers cannot keep water contained into the shower system. The shower system shall have a filtration system that filters water down to 5 microns prior to discharge into a storm drain system. Soap, shampoo, towels and a waste bag for disposal of contaminated disposable PPE is required to be in the decontamination chamber system.

The floor of the dirty chamber shall have two layers of 6-mil poly. The top layer of the poly shall be replaced daily or more often if needed to maintain an acceptably clean decontamination system at the third-party consultant's discretion. Failure to keep any chamber of decon system in acceptable condition will be grounds for a work stoppage until cleaning has occurred and procedures have been corrected.

The contractor may opt to construct waste load-out chambers at containment areas. These chambers can be larger than worker decontamination systems, but the required air pressure differential must be maintained at all times and system shall be of reasonable size for the contractor to manage. Load-out chambers must be constructed of 6-mil poly and framing shall be sufficient to provide a sturdy construction. There must be self-sealing flaps between chambers of the load-out chamber. Load-out chambers can be reduced to no less than two chambers and only upon approval by the AHERA Project Designer or their onsite representative. Asbestos and/or lead signage shall be posted as appropriate at the load-out chamber and required PPE shall be worn in the load-out chambers as needed to comply with posted signage.

At no time will any ride-on equipment be used to access the load-out chambers to move waste. At no time will flaps of the waste load-out chambers or the worker decontamination system be pinned back to create a "tunnel" that does not provide an airlock between air chambers. At no time will a waste bin be directly attached to a containment or load-out chamber. At no time will waste be loaded into the load-out or decontamination system which prevent egress/ingress in the event of an emergency. Failure by the contractor's onsite supervisor to monitor work crew and prevent this from occurring is grounds for dismissal of the supervisor and potentially crew members that fail to correct actions.

Lead Wipe Sampling Criteria

The District will hire the independent third-party consultant to perform lead wipe sampling prior to commencement of work. The consultant will collect wipe samples from floor and/or adjacent horizontal surfaces within the work areas to verify lead dust levels prior to work commencing. If cleaning of a surface to remove a detected lead hazard is required, the contractor shall be notified, and the hazardous materials contractor will be required to pre-clean to remove the hazard.

At the conclusion of lead disturbances, a post wipe sample will be collected from the interior work area, following removal of the containment poly. If post project wipe samples indicate that an EPA lead hazard exists, or if samples indicate a higher level of lead on surfaces than pre-project wipe samples showed, then recleaning of the work area will be necessary. Recleaning process will be required to be repeated until wipe samples indicate lead levels are below both current EPA hazard levels and below pre-wipe sample levels.

Disposal Requirements

Asbestos

As noted above, all waste must be either double-bagged in 6-mil poly waste bags or sealed in two separate layers of 6-mil poly. Waste bags shall be sealed in a “goose-neck” fashion; “burrito-wrapped” materials shall have staggered seams to create a leak-tight container.

All asbestos-containing waste must be identified with OSHA labeling and EPA labeling is required for those materials determined to be friable or made friable during removal. The asbestos-containing materials identified as a non-friable asbestos-containing material may be disposed of as a non-hazardous asbestos-containing material waste unless made friable during removal or removed using mechanical means. For non-friable materials that are made friable or removed using mechanical means, and materials that are considered friable by the NESHAP regulation, the materials must be disposed of as a regulated asbestos-containing material (RACM) waste.

All asbestos waste that will not fit in poly waste bags, such as fire doors, must be double-wrapped in 6-mil poly before leaving the job site.

The contractor will need to provide fully enclosed, lockable waste bins for all waste created on this project. Waste bin will need to be labeled with asbestos signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded. Hazardous and non-hazardous asbestos wastes may not be mixed within the same waste bin.

Asbestos waste shall be hauled from the site by a properly licensed waste hauler and disposed of at a waste facility that will accept the waste. Asbestos waste and lead waste cannot be mixed.

Lead

Contractor is responsible for the waste characterization profiling of all lead waste to be disposed of. Copies of the laboratory results, including chain-of-custody, must be provided to WCSD ES&A or independent third-party consultant prior to disposal.

Lead-containing materials may be recycled, but a letter signed by the recycling facility acknowledging the lead-content of materials must be provided by the contractor prior to removal of such materials from the site. Materials that contain asbestos may never be recycled.

The contractor will need to provide a fully enclosed, lockable waste bin for all waste created on this project. Waste bin will need to be labeled with lead signage once the waste is loaded into the bin. Waste bins shall be lined with one layer of 6-mil poly prior to waste being loaded. Lead waste cannot be mixed with asbestos waste.

General Waste Bin Requirements

Waste bins will need to arrive onsite clean of debris or any other waste and in proper functioning order. Waste bins may be rejected by WCSD ES&A staff or District's independent third-party consultant if these conditions are not met, with no extra charge to the District. Plywood or similar material shall be placed below the casters or feet of the bin to prevent damage to site grounds. The contractor will be responsible for any damage to the site grounds by waste bin delivery, storage, or haul-off.

Clearance

Once an area passes visual clearance for the material abated, clearance air or wipe sampling will be performed by the ES&A Department or District's independent third-party consultant. Following are the requirements that must be met for clearance to be met and allow containment removal so that non-remediation personnel may re-occupy the space:

Asbestos

In containment areas where asbestos-containing materials are abated, clearance air samples will be collected in accordance with the US EPA AHERA regulation after passage of the final visual inspection. Samples will be collected in an aggressive fashion and analyzed by either phase contrast microscopy or transmission electron microscopy as required by AHERA, based on the amount of material abated within the containment area. Each sample set must meet clearance criteria set forth by the AHERA regulation for the analysis performed.

For exterior areas, passage of the final visual inspection will constitute clearance for asbestos abatement activities.

Lead

In the event that a lead hazard has been created by a contractor, such as improper disturbance of painted surfaces outside of a contained area, the District's ES&A staff or independent third-party consultant will collect clearance dust wipe or soil samples in the affected area. If a lead hazard has been created, the contractor performing the improper disturbance will be responsible for all cleaning costs required for the lead remediation contractor to abate the hazard and for collection of clearance dust wipe or soil samples to document that the lead hazard has been remediated.

As noted previously, pre-job and post-job lead wipe samples will be collected in spaces to verify the contractor has not created a lead hazard by removal of their containment area and to verify that the spaces can be re-occupied by non-lead trained personnel.

For exterior areas, passage of the final visual inspection will constitute clearance for lead remediation activities.

The contractor is responsible for all costs of labor and laboratory analysis for the collection of clearance air or wipe samples past the initial sample set collected within a containment area. This includes collection of samples due to failure to meet clearance requirements on the initial set of samples, contractor setting up more containment areas that reasonably expected, and contractor improper disturbance to surfaces after samples are collected but before analysis is completed.

Created by: Daniel Prado, FACS, IJPM-2057, US EPA LBP-R-I214705-1

Reviewed by: Chris Chipponeri, FACS, IJPM-1410, US EP LBP-R-128230-2

Date: September 14, 2022



2024-2025 Balanced Calendar

July 2024							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 0
	1	2	3	4	5	6	
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	
21	22	23	24	25	26	27	
28	29	30	31				

January 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 19
			1	2	3	4	January 1 - 3 - Winter Break
5	6	7	8	9	10	11	January 6 - School Resumes
12	13	14	15	16	17	18	
19	20	21	22	23	24	25	January 20 - Martin Luther King, Jr. Day
26	27	28	29	30	31		

August 2024							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 15
				1	2	3	August 6 - 8 - Teacher Professional Dev. Days
4	5	6	7	8	9	10	August 9 - Teacher Work Day
11	12	13	14	15	16	17	August 12 - First Day of School for Students
18	19	20	21	22	23	24	August 12 - 16 - Kindergarten Testing Week
25	26	27	28	29	30	31	August 19 - First Day of Kindergarten

February 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 19
						1	
2	3	4	5	6	7	8	
9	10	11	12	13	14	15	
16	17	18	19	20	21	22	February 17 - President's Day
23	24	25	26	27	28		* February 24 - 28 - Spring Conference Week for some elementary schools. Please check with your school for details.

September 2024							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 20
1	2	3	4	5	6	7	September 2 - Labor Day
8	9	10	11	12	13	14	
15	16	17	18	19	20	21	
22	23	24	25	26	27	28	
29	30						

March 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 11
						1	
2	3	4	5	6	7	8	March 4 - College and Career Readiness Assessment for high schools only. Awaiting confirmation from NDE.
9	10	11	12	13	14	15	March 14 - End of Grading Period
16	17	18	19	20	21	22	March 17 - 28 - Spring Break
23	24	25	26	27	28	29	
30	31						

October 2024							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 17
		1	2	3	4	5	
6	7	8	9	10	11	12	October 7 - 11 - Fall Break
13	14	15	16	17	18	19	October 18 - End of Grading Period
20	21	22	23	24	25	26	October 18, 21 - 24 - Conference Week
27	28	29	30	31			October 25 - Nevada Day Observance

April 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 22
		1	2	3	4	5	
6	7	8	9	10	11	12	
13	14	15	16	17	18	19	
20	21	22	23	24	25	26	
27	28	29	30				

November 2024							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 17
					1	2	
3	4	5*	6	7	8	9	November 5 - Election Day (See * below)
10	11	12	13	14	15	16	November 11 - Veterans Day
17	18	19	20	21	22	23	
24	25	26	27	28	29	30	November 27 - 29 - Thanksgiving Break

May 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 21
				1	2	3	
4	5	6	7	8	9	10	
11	12	13	14	15	16	17	
18	19	20	21	22	23	24	
25	26	27	28	29	30	31	May 26 - Memorial Day

December 2024							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 14
1	2	3	4	5	6	7	
8	9	10	11	12	13	14	December 19 - End of Grading Period
15	16	17	18	19	20	21	December 20 - Teacher Work Day
22	23	24	25	26	27	28	December 23 - January 3 - Winter Break
29	30	31					

June 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 5
1	2	3	4	5	6	7	June 6 - End of Grading Period
8	9	10	11	12	13	14	June 6 - Last Day of School
15	16	17	18	19	20	21	June 9, 10, 11 - Contingency Days
22	23	24	25	26	27	28	June 19 - Juneteenth
29	30						

*November 5, 2024 is a non-student day used for professional development but counted as a day in session per NAC 387.140 (2a).	Number of Days Per Quarter	44	39	48	49	180
	Number of Days Per Semester	83		97		180
	Contingency Days: June 9, 10, 11					

Teacher Work Days: August 6 - 9, December 20
Teacher Professional Dev Day: November 5



2025-2026 BALANCED CALENDAR

July 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 0
		1	2	3	4	5	
6	7	8	9	10	11	12	
13	14	15	16	17	18	19	
20	21	22	23	24	25	26	
27	28	29	30	31			

January 2026							No School on Shaded Days
J	M	T	W	TH	F	S	# of School Days = 19
				1	2	3	January 1 - 2 - Winter Break
4	5*	6	7	8	9	10	January 5 - Teacher Professional Dev. Day
11	12	13	14	15	16	17	
18	19	20	21	22	23	24	January 19 - Martin Luther King, Jr. Day
25	26	27	28	29	30	31	

August 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 15
					1	2	
3	4	5	6	7	8	9	August 5 - 7 Teacher Professional Dev. Days
10	11	12	13	14	15	16	August 8 - Teacher Work Day
17	18	19	20	21	22	23	August 11 - First Day of School for Students
24	25	26	27	28	29	30	August 11 - 15 - Kindergarten Testing Week
							August 18 - First Day for Kindergarten Students

February 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 19
1	2	3	4	5	6	7	
8	9	10	11	12	13	14	
15	16	17	18	19	20	21	February 16 - President's Day
22	23	24	25	26	27	28	February 23 - 27 - Spring Conference week for Elementary Schools only.

September 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 21
	1	2	3	4	5	6	September 1 - Labor Day
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	
21	22	23	24	25	26	27	
28	29	30					

March 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 12
1	2	3	4	5	6	7	March 3 - College and Career Readiness Assessment for high schools only. Awaiting confirmation from NDE.
8	9	10	11	12	13	14	March 13 - End of Grading Period
15	16	17	18	19	20	21	March 16 - March 27 - Spring Break
22	23	24	25	26	27	28	
29	30	31					

October 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 17
			1	2	3	4	October 6 - 10 - Fall Break
5	6	7	8	9	10	11	October 13 - Teacher Professional Dev. Day
12	13*	14	15	16	17	18	October 17 - End of Grading Period
19	20	21	22	23	24	25	October 24, 27 - 30 - Conference Week
26	27	28	29	30	31		October 31 - Nevada Day

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

November 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 16
						1	
2	3	4	5	6	7	8	
9	10	11	12	13	14	15	November 11 - Veterans Day
16	17	18	19	20	21	22	
23	24	25	26	27	28	29	November 26 - 28 - Thanksgiving Break

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

December 2025							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 14
	1	2	3	4	5	6	
7	8	9	10	11	12	13	
14	15	16	17	18	19	20	December 18 - End of Grading Period
21	22	23	24	25	26	27	December 19 - Teacher Work Day
28	29	30	31				December 22 - January 2 - Winter Break

June 2026							No School on Shaded Days
S	M	T	W	TH	F	S	# of School Days = 5
	1	2	3	4	5	6	June 5 - End of Grading Period
7	8	9	10	11	12	13	June 5 - Last Day of School
14	15	16	17	18	19	20	June 9 - Primary Election Day
21	22	23	24	25	26	27	June 8, 9, 10 - Contingency Days
28	29	30					June 19 - Juneteenth

* October 13, 2025 & January 5, 2026 is a non-student day used for professional development but counted as a day in session per NAC 387.120 (4)

Number of Days per Quarter	44	39	48	49	180
Number of Days per Semester	83		97		180
Contingency Days: June 8, 9, 10					

Teacher Work Days: August 5 - 8, December 19
Teacher Professional Dev Days: October 13, 2025 & January 5, 2026

BID FORM

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

Bid #: 25-15-B-09-DA
PWP # WA-2025-031

Having carefully examined all of the Bid Specifications entitled **Getto Transportation Center Modernization Project**, dated September 30, 2024; and the Drawings dated August 15, 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	\$1,700,000.00
C.	TOTAL – BASE BID 1 AND FORCE ACCOUNT (The Sum of Box A + Box B): All labor and materials for the GETTO TRANSPORTATION CENTER MODERNIZATION PROJECT 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 as phased in the Special Notifications with an overall completion date on or before September 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 #: 25-15-B-09-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: **GETTO TRANSPORTATION CENTER MODERNIZATION PROJECT**

BID #: **25-15-B-09-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: **GETTO TRANSPORTATION CENTER MODERNIZATION PROJECT**

BID #: **25-15-B-09-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: _____
(Print Name of Affiant)

Title: _____

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 themselves 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.

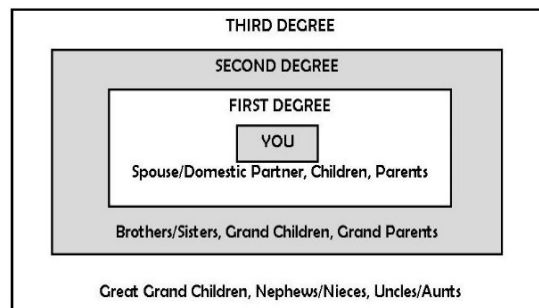
By signing this form, I certify and acknowledge that I am a duly authorized agent of the VENDOR/CONTRACTOR named above and that failure to disclose all facts relative to a conflict and/or potential conflict of interest (ethical standards) with regard to the specific solicitation, project, and/or contract 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.

(Seal)

Principal

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.

(Seal)

Principal

By: _____

Surety

By: _____

Address:

(Seal)

Phone: _____

PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS: That WHEREAS, the Board of Trustees, Washoe County School District in the State of Nevada has awarded to

_____,
Hereinafter designated as "Principal": a contract dated _____,
for _____

a copy of which contract is attached hereto and by reference made a part hereof, and hereinafter referred to as the "Contract".

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

NOW, THEREFORE, we, the Principal, and _____
_____, as Surety, are held and firmly bound unto the Board of Trustees, Washoe County School District in the State of Nevada in the sum of

Dollars (\$_____), lawful money of the United States, being no less than one hundred per cent (100%) of the estimated Contract Cost of the work, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

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

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

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

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

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

Principal

(Seal)

By: _____

Surety

By: _____

Address:

(Seal)

Phone: _____

SECTION 01001 – CONSTRUCTION PROCEDURES FOR EXISTING SCHOOL SITES

PART 1 – GENERAL

1.1 DESCRIPTION

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

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

- A. It is a felony to transport any alcoholic beverages, drugs, weapons or ammunition of any kind on WCSD property
- B. Any contact or conversation with students is prohibited.
- C. Smoking is prohibited on all WCSD property.
- D. Working hours inside the existing perimeter and existing building will be coordinated with WCSD.
- E. Storage of materials inside the existing perimeter and buildings will be coordinated with WCSD Facilities Management Department.
- F. Construction operations shall be confined to the areas permitted under the contract. Areas beyond indicated work areas are not to be disturbed. Conform to site rules and regulations affecting the work.
- G. Keep driveways and entrances serving the premises clear and available at all times. Do not use these areas for parking or storage of materials.
- H. Passenger cars, trucks and motorized construction equipment, when parked and unattended, shall be locked and the ignition key removed. Do not leave any such vehicle with the motor running.
- I. Limitations on site usage, as well as specific requirements that impact site utilization are indicated on the drawings and any other contract documents. Allocate available space equitably among sub-contractors needing both access and space so as to produce the best overall efficiency. Schedule deliveries to minimize space and time requirements for storage of materials and equipment.

SECTION 01001 – CONSTRUCTION PROCEDURES FOR EXISTING SCHOOL SITES

J. All refuse will be removed daily.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01001

SECTION 01010 - SUMMARY OF WORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROJECT DESCRIPTION

- A. Project to entail work as described in scope of work.
- B. The project shall consist of all on and off-site improvements, as shown in the contract documents.

1.3 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises (construction area) for construction operations. The Contractor's use of the premises (construction area) is limited only by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of project.
- B. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment site.

1.4 OWNER OCCUPANCY

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

1.5 OWNER FURNISHED ITEMS

- A. The Owner will provide certain pieces of equipment and accessories that are to be installed and connected by the Contractor.
 - 1. The Owner will arrange and pay for delivery of Owner furnished items in accordance with the Contractor's construction schedule, and will inspect deliveries for damage.
 - 2. If Owner furnished items are damaged, defective or missing, the Owner will arrange for replacement. The Owner will also arrange for manufacturer's field

SECTION 01010 - SUMMARY OF WORK

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

VOLUME 1

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A0.02A	TYPICAL ACCESSIBILITY DETAILS
A0.02B	TYPICAL ACCESSIBILITY DETAILS
A0.11	CODE ANALYSIS & EXITING DIAGRAMS
A0.11-WB	CODE ANALYSIS & EXITING DIAGRAMS – WASH BAY
A0.12	FIRESTOP ASSEMBLIES
A0.13	FIRESTOP ASSEMBLIES
A0.20A	IECC ENVELOPE COMPLIANCE SHEETS
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A0.21	ASSEMBLIES
A0.22	EXTERIOR WALL ASSEMBLIES – BUILDING A
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A0.41	PHASING PLAN

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C0.02	CIVIL – LEGEND
C0.03	CIVIL – SITE KEYPLAN
C1.00	CIVIL – DEMO – KEYPLAN
C1.01	CIVIL – DEMO - SOUTHWEST
C1.02	CIVIL – DEMO - SOUTHEAST
C1.03	CIVIL – DEMO - NORTHWEST
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C2.00	CIVIL – SITE PLAN AND ROW EXHIBIT
C2.01	CIVIL – SITE - SOUTHWEST
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C2.03	CIVIL – SITE - NORTHWEST
C2.04	CIVIL – SITE - NORTHEAST
C3.00	CIVIL – GRADING KEYPLAN
C3.01	CIVIL – GRAD - SOUTHWEST
C3.02	CIVIL – GRAD - SOUTHEAST
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C3.05	CIVIL – EROSION CONTROL PLAN
C4.00	CIVIL – UTILITY KEY
C4.01	CIVIL – UTILITY SOUTHWEST
C4.02	CIVIL – UTILITY SOUTHEAST
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C5.00	CIVIL – STRIPING & SIGNAGE - KEYPLAN
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SECTION 01015 – SCHEDULE OF DRAWINGS

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C6.00	CIVIL - DETAILS
C6.01	CIVIL - DETAILS
C6.02	CIVIL - DETAILS
C6.03	CIVIL - DETAILS
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VOLUME 2

GENERAL

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E2.14	LIGHTING PHOTOMETRIC PLAN MEZZANINE
E2.15	EMERGENCY LIGHTING PHOTOMETRIC PLAN ADMIN
E2.16	EMERGENCY LIGHTING PHOTOMETRIC PLAN YELLOW FLEET
E2.17	EMERGENCY LIGHTING PHOTOMETRIC PLAN WHITE FLEET
E2.18	EMERGENCY LIGHTING PHOTOMETRIC PLAN MEZZANINE
E3.01	POWER PLAN ADMIN
E3.02	POWER PLAN YELLOW FLEET
E3.03	POWER PLAN WHITE FLEET
E3.04	POWER PLAN MEZZANINE
E4.01	MECHANICAL POWER PLAN ADMIN
E4.02	MECHANICAL POWER PLAN YELLOW FLEET
E4.03	MECHANICAL POWER PLAN WHITE FLEET
E4.04	MECHANICAL POWER PLAN MEZZANINE
E4.05	MECHANICAL POWER PLAN ROOF
E5.01	FIRE ALARM PLAN ADMIN
E5.02	FIRE ALARM PLAN YELLOW FLEET
E5.03	FIRE ALARM PLAN WHITE FLEET
E5.04	FIRE ALARM PLAN MEZZANINE
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E6.02	DETAILS
E6.03	DETAILS
E6.04	FUEL STATION DETAILS
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E8.01	FIXTURE SCHEDULE & IECC CALCULATIONS
E8.02	PANEL SCHEDULES
E8.03	PANEL SCHEDULES
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T0.02	TELECOM DETAILS
T0.03	TELECOM ONELINE DIAGRAMS
T0.04	ENLARGED TELECOM ROOM PLANS
T0.05	EMERGENCY RESPONDER RADIO SYSTEM DETAILS
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T0.13	SECURITY DOOR ACCESS CONTROL SYSTEM ONELINE DIAGRAMS
T0.14	SECURITY INSTRUCTION DETECTION SYSTEM ONELINE DIAGRAMS
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T0.16	SECURITY CCTV CAMERA MOUNTING DETAILS
T1.01	TELECOM SITE PLAN
T2.01	TELECOM PLAN ADMIN
T2.02	TELECOM PLAN YELLOW FLEET
T2.03	TELECOM PLAN WHITE FLEET

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T2.04	TELECOM PLAN MEZZANINE
T2.05	TELECOM ROOF PLAN
T3.01	SECURITY PLAN ADMIN
T3.02	SECURITY PLAN YELLOW FLEET
T3.03	SECURITY PLAN WHITE FLEET
T3.04	SECURITY PLAN MEZZANINE

WASH BAY ARCHITECTURAL

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WB-A2.01	WASH BAY FLOOR AND ROOF PLANS
WB-A3.01	WASH BAY EXTERIOR ELEVATIONS
WB-A4.01	WASH BAY SECTIONS

WASH BAY STRUCTURAL

WB-S2.1	WASH BAY PLAN
WB-S2.2	WASH BAY DETAILS

WASH BAY MECHANICAL

WB-M2.01	WASH BAY MECHANICAL FLOOR PLAN
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WASH BAY PLUMBING

WB-P2.01	WASH BAY PLUMBING FLOOR PLANS
WB-P4.01	WASH BAY PLUMBING ISOMETRICS AND SECTIONS
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WASH BAY ELECTRICAL

WB-E2.05	LIGHTING PLAN WASH BAY
WB-E2.15	LIGHTING PHOTOMETRIC PLAN WASH BAY
WB-E2.20	EMERGENCY LIGHTING PHOTOMETRIC PLAN WASH BAY
WB-E3.05	POWER PLAN WASH BAY & FUEL ISLAND
WB-E4.06	MECHANICAL POWER PLAN WASH BAY
WB-E5.06	FIRE ALARM PLAN WASH BAY

WASH BAY TELECOMM

WB-T2.06	TELECOM PLAN WASH BAY
WB-T3.05	SECURITY PLAN WASH BAY

GENERAL PHASE 3

A0.00-3	COVER – PHASE 3
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SECTION 01015 – SCHEDULE OF DRAWINGS

A0.01-3	SHEET INDEX, GENERAL NOTES, SYMBOLS AND ABBREVIATION
A0.41-3	PHASING PLAN

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.C0.01	CIVIL – GENERAL NOTES
.C0.02	CIVIL - LEGEND
.C0.03	CIVIL – SITE KEYPLAN
.C1.00	CIVIL – DEMO - KEYPLAN
.C1.01	CIVIL – DEMO - SOUTHWEST
.C1.02	CIVIL – DEMO - SOUTHEAST
.C1.03	CIVIL – DEMO - NORTHWEST
.C1.04	CIVIL – DEMO - NORTHEAST
.C2.00	CIVIL – SITE PLAN AND ROW EXHIBIT
.C2.01	CIVIL – SITE - SOUTHWEST
.C2.02	CIVIL – SITE - SOUTHEAST
.C2.03	CIVIL – SITE - NORTHWEST
.C2.04	CIVIL – SITE - NORTHEAST
.C3.00	CIVIL – GRADING KEY PLAN
.C3.01	CIVIL – GRAD - SOUTHWEST
.C3.02	CIVIL – GRAD - SOUTHEAST
.C3.03	CIVIL – GRAD - NORTHWEST
.C3.04	CIVIL – GRAD - NORTHEAST
.C3.05	CIVIL – EROSION CONTROL PLAN
.C4.00	CIVIL – UTILITY KEY
.C4.01	CIVIL – UTILITY - SOUTHWEST
.C4.02	CIVIL – UTILITY - SOUTHEAST
.C4.03	CIVIL – UTILITY - NORTHWEST
.C4.04	CIVIL – UTILITY - NORTHEAST
.C5.00	CIVIL – STRIPING & SIGNAGE - KEYPLAN
.C5.01	CIVIL – STRIPING & SIGNAGE - SOUTHWEST
.C5.02	CIVIL – STRIPING & SIGNAGE - SOUTHEAST
.C5.03	CIVIL – STRIPING & SIGNAGE - NORTHWEST
.C5.04	CIVIL – STRIPING & SIGNAGE - NORTHEAST
.C6.00	CIVIL - DETAILS
.C6.01	CIVIL - DETAILS
.C6.02	CIVIL - DETAILS
.C6.03	CIVIL - DETAILS
.C6.04	CIVIL - DETAILS
.C6.05	CIVIL – DETAILS
.C6.06	CIVIL - DETAILS
.C6.07	FENCE & GATE DETAILS

LANDSCAPING

.L1.0	LANDSCAPE GENERAL NOTES AND KEY PLAN
.L2.0	LANDSCAPE PLAN
.L2.1	LANDSCAPE PLAN

SECTION 01015 – SCHEDULE OF DRAWINGS

.L3.0	PLANTING DETAILS
.L4.0	IRRIGATION GENERAL NOTES AND KEY PLAN
.L5.0	IRRIGATION PLAN
.L5.1	IRRIGATION PLAN
.L5.2	IRRIGATION PLAN
.L6.0	IRRIGATION DETAILS
.L6.1	IRRIGATION DETAILS

ELECTRICAL

E0.01-P	ELECTRICAL LEGEND AND DRAWING SCHEDULE
E0.02-P	ONELINE DIAGRAM
E1.01-P	SITE ELECTRICAL DEMOLITION PLAN
E1.02-P	SITE LIGHTING PLAN
E1.03-P	SITE LIGHTING PHOTOMETRIC PLAN
E1.04-P	SITE POWER PLAN
E6.01-P	DETAILS
E6.02-P	DETAILS
E8.01-P	SCHEDULES & IECC CALCULATIONS

TELECOM

T0.01-P	TELECOM LEGEND, GENERAL NOTES & DRAWING SCHEDULE
T0.02-P	TELECOM DETAILS
T0.03-P	SECURITY GENERAL NOTES & LEGEND
T0.04-P	SECURITY CCTV SCHEDULE AND ONELINE DIAGRAM
T1.01-P	TELECOM SITE 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)

**SECTION 01020 – PERSONNEL SAFETY CHECK APPLICATION
(NEW CONSTRUCTION)**

**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 contendere 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.

SECTION 01027 – APPLICATIONS FOR PAYMENT

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 categorically.
 - 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 quantity. 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

SECTION 01027 – APPLICATIONS FOR PAYMENT

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 categories including breakout of labor and material.
 - b. General Conditions performed by subcontract work shall be broken down to individual categories 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.

SECTION 01027 – APPLICATIONS FOR PAYMENT

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)

SECTION 01027 – APPLICATIONS FOR PAYMENT

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 facility 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*

SECTION 01027 – APPLICATIONS FOR PAYMENT

*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

SECTION 01027 – APPLICATIONS FOR PAYMENT

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.

SECTION 01035 - MODIFICATION PROCEDURES

- 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 unforeseen 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

SECTION 01035 - MODIFICATION PROCEDURES

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

SECTION 01035 - MODIFICATION PROCEDURES

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: _____

SECTION 01035 - MODIFICATION PROCEDURES

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: _____

SECTION 01035 - MODIFICATION PROCEDURES

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.: _____

SECTION 01035 - MODIFICATION PROCEDURES

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.

SECTION 01040 – COORDINATION

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 all required motor starters.

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- 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 $\frac{1}{4}" = 1'0"$.
 2. Wall elevations shall include dimensioned sizes and locations for all door, window and mechanical openings and penetrations, beam and joist

SECTION 01040 – COORDINATION

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.

SECTION 01040 – COORDINATION

- 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

SECTION 01040 – COORDINATION

- 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. Washoe County School District (WCSD) to work with Contractor to ensure directory for project is current.
- 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 set up, used, routing & naming protocols, permissions & restrictions, roles & responsibilities, etc.
- E. Permissions will be granted by WCSD to enable the general contractor to solely manage the district-provided Procore software. The contractor shall be responsible for loading specifications, plans and all project-related documents, and for managing all aspects to ensure proper functionality of the program. The owner will establish folder(s) within “documents” for contractor use. A file tree within the contractors’ documents file(s) will be established by the contractor for district-hired consultants (i.e. special inspectors and the construction management firm).
- F. At the conclusion of the project, all project documents shall remain on Procore for district use. The contractor shall be responsible to comply with all sections of 01700 Project Closeout specification requirements.

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.

SECTION 01041 – PROJECT MANAGEMENT SOFTWARE

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

SECTION 01041 – PROJECT MANAGEMENT SOFTWARE

- 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.

SECTION 01041 – PROJECT MANAGEMENT SOFTWARE

- 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

- Q. Fully web based with mobile apps for Windows, iOS and Android phones.
- R. Accessible without logging in through a virtual private network (VPN).
- S. Works on the current version of Internet Explorer, Google Chrome, Mozilla firefox and Apple Safari browsers.
- T. Can generate emails automatically, and all attachments are included in the emails via download links to avoid emails not being delivered due to size.
- U. 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.

SECTION 01041 – PROJECT MANAGEMENT SOFTWARE

- 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.

SECTION 01045 - CUTTING AND PATCHING

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

SECTION 01045 - CUTTING AND PATCHING

- 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.

SECTION 01045 - CUTTING AND PATCHING

- 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.

SECTION 01045 - CUTTING AND PATCHING

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.

SECTION 01050 - FIELD ENGINEERING

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

SECTION 01050 - FIELD ENGINEERING

- 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 Commissioner's website <https://labor.nv.gov/>

1.2 SUMMARY

- A. This section includes administrative and procedural requirements for submittals required for performance of the work, including the following:
 - 1. Contractor/Subcontractor Notification
 - 2. Completion Notification
 - 3. Weekly Wage and Hour Report of Public Works Contractors.
 - 4. Weekly Wage and Hour Report submittal log.
 - 5. Certification of bidder regarding penalties for noncompliance
 - 6. Certification of bidder, proposed contractor or subcontractor regarding debarment, suspension, ineligibility of voluntary exclusion.
- B. Related Sections: The following section(s) may contain requirements that relate to this section if included:
 - 1. SECTION - 01027 APPLICATIONS FOR PAYMENT
 - 2. SECTION – 01300 SUBMITTALS

1.3 SUBMITTAL PROCEDURES

- A. Compensation:

1. No extension of contract time, overhead, or profit will be authorized because of failure to transmit any required submittals or payroll report submittals to the Owner sufficiently in advance of progress payment submittals.
2. No extension of contract time will be authorized because of failure to transmit or report of any forms.

B. Required Submittals

1. CONTRACTOR/SUBCONTRACTOR NOTIFICATION

- a. The Apparent Low Bidder is requested to submit the information on the Comprehensive Contractor/Subcontractor List for the Prime Bidder and all named (used) Subcontractors whom they engage for work within two (2) business days after Recommendation of Award, which will be supplied by the Purchasing Department.
- b. It shall be the Contractor's responsibility to comply and submit any required forms directly to the Office of the Labor Commissioner's as required by NRS 338.

2. COMPLETION NOTIFICATION

The contractor shall notify Washoe County School District when completion of all work performed under the contract is complete.

3. WEEKLY WAGE AND HOUR REPORTING OF PUBLIC WORKS CONTRACTORS

- a. The contractor and all subcontractors are required to submit Certified Weekly Wage and Hour Reports of Public Work Contractors for each weekly payroll to Washoe County School District through the use of LCP Tracker, a paperless online system for filling certified payroll. The first weekly report will begin on the Notice to Proceed date and conclude on the following Saturday. If the Notice to Proceed date falls on a Saturday, the first report will only include reporting for that day. All successive reports will begin on the following Sunday and conclude on the following Saturday. All subcontractor report numbers shall coincide with the General Contractors report numbers. If the contractor or subcontractors do not work during any weekly reporting period they still must submit a report

indicating no public work project hours were performed for that weekly period. When contract scope of work is completed including punch list work, the last report is to be clearly marked "FINAL REPORT."

- b. Weekly Wage and Hour Report of Public Works Contractors and Weekly Wage and Hour Report submittal log must be submitted into Washoe County School District LCP Tracker system within fifteen (15) calendar days following the end of the month being reported.
- c. The Prime contractor is required to designate an individual as Prime Approver for the project. The Prime Approver will oversee the reporting for all subcontractors of all tiers on the project. WCSD will set up the Prime Approver Account for the project. Thereafter, the Prime Approver will have the responsibility to use the Account to approve all payroll on the project.
- d. The prime contractor is required to assign subcontractors within the LCP Tracker system to the project and to ensure that all subcontractors are aware of the necessity to file payrolls electronically, are set up within the system and all required payrolls are filed by subcontractors of all tiers.

1.4 OWNER'S ACTION

- A. The owner will review each submittal, mark to indicate action taken, and provide review and acceptance.
 - 1. Compliance with submittal requirements is the Contractor's responsibility.

1.5 POSTINGS/SIGNAGE

- A. Each contractor engaged on a public work must post the applicable prevailing rate of wages for the project on the site of the public work in a generally visible place to workmen.
- B. Each contractor engaged in a public work must provide a sign with a white background and 6" black lettering stating, "Posted prevailing wages apply to this public works project". This sign must be posted on the site of the public work in a generally visible place to workmen. This will be maintained by the Contractor throughout the construction phase from the Notice to Proceed date through completion of the project.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 01110

WASHOE COUNTY SCHOOL DISTRICT

WEEKLY WAGE AND HOUR REPORT SUBMITTAL LOG

Report Number	Contractor	Week Ending Date	Date Submitted

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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		
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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		
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Report Hours For Above Referenced Public Works Project Only

Employee Name & State/Jurisdiction that Issued Identification	Work Classification	Hours Worked By Day								Total Hours For Week	Hourly Rate Of Pay including fringe	Hourly Fringe Benefit Contribution					Gross Amount Earned For Week	Net Wage Paid For Week
			S	M	T	W	T	F	S			H & W	Pen.	Vac.	App. Trg	Other		
			1/0	1/0	1/0	1/0	1/0	1/0	1/0									
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Report Hours For Above Referenced Public Works Project Only

Employee Name & State/Jurisdiction that Issued Identification	Work Classification	Hours Worked By Day								Total Hours For Week	Hourly Rate Of Pay including fringe	Hourly Fringe Benefit Contribution					Gross Amount Earned For Week	Net Wage Paid For Week
			S	M	T	W	T	F	S			H & W	Pen.	Vac.	App. Trg	Other		
			1/0	1/0	1/0	1/0	1/0	1/0	1/0									
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Report Hours For Above Referenced Public Works Project Only

STATE OF NEVADA
Office of the Labor Commissioner
STATEMENT OF COMPLIANCE

In compliance with the provisions of Chapters 338 of NRS and NAC, respectively, I, as an officer, owner or director of the undersigned contractor, hereby certify that this report is a true and accurate statement of worker's earnings employed on this Public Works contract by the undersigned contractor for the following payroll period:

_____, _____, _____ to _____, _____, _____
Month and Day Year Month and Day Year

I further certify:

1. That no deductions have been made from the wages earned by any person so listed other than those permissible or required by law.
2. That any apprentice listed herein is registered in a bona fide apprenticeship program.
3. Check all that apply:
 - ☐ The contractor is signatory to a collective bargaining agreement with some or all of its employees.
 - ☐ Each employee listed has been paid the required applicable wages plus the amount of fringe benefits listed in their contract.
 - ☐ Each employee listed has been paid the required applicable wages per hour with no fringe benefit contributions paid by the contractor.

 - ☐ Prime Contractor
 - ☐ Subcontractor

Contractor Name:	Address:
Telephone:	Fax:

Printed Name / Title Signature Date

NRS 338.070:

4. The contractor and each subcontractor shall keep or cause to be kept an accurate record showing the name and the actual per diem, wages and benefits paid to each workman employed by him in connection with the public work.
5. The record must be open at all reasonable hours to the inspection of the public body awarding the contract, and its officers and agents. The contractor or subcontractor shall ensure that a copy of the record for each calendar month is received by the public body awarding the contract no later than 15 days after the end of the month. The copy must be open to public inspection as provided in NRS 239.010. The record in the possession of the public body awarding the contract may be discarded by the public body 2 years after final payment is made by the public body for the public work.
6. Any contractor or subcontractor, or agent or representative thereof, performing work for a public work who neglects to comply with the provisions of this section is guilty of a misdemeanor.



NON-PERFORMANCE PAYROLL REPORT FOR PUBLIC WORKS PROJECTS

Pursuant to Chapter 338 of NRS and NAC, respectively, the contractor and each subcontractor shall keep or cause to be kept an accurate record showing the name and the actual per diem, wages and benefits paid to each workman employed by him in connection with the public work. The contractor or subcontractor shall ensure that a copy of the record for each calendar month is received by the public body awarding the contract no later than 15 days after the end of the month.

Report #	<input type="text"/>	<input type="checkbox"/> Regular Weekly Report	<input type="checkbox"/> Final Report	Bid/Project #	<input type="text"/>	PWP-	<input type="text"/>
Project Title	<input type="text"/>			Public Body Awarding Contract	WASHOE COUNTY SCHOOL DISTRICT		
Prime Contractor Name & Address	<input type="text"/>					License #	<input type="text"/>
Subcontractor Name & Address	<input type="text"/>					License #	<input type="text"/>
Payroll period	<input type="text"/> Month and Day	<input type="text"/> Year	to	<input type="text"/> Month and Day	<input type="text"/> 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.

<input type="text"/>	<input type="text"/>	<input type="text"/>
Name & Title (please print)	Signature	Date

STATE OF NEVADA

JOE LOMBARDO
GOVERNOR

DR. KRISTOPHER SANCHEZ
DIRECTOR

BRETT K. HARRIS, ESQ.
LABOR COMMISSIONER



OFFICE OF THE LABOR COMMISSIONER
1818 COLLEGE PARKWAY, SUITE 102
CARSON CITY, NV 89706
PHONE: (775) 684-1890
FAX (775) 687-6409
OFFICE OF THE LABOR COMMISSIONER
3340 WEST SAHARA AVENUE
LAS VEGAS, NV 89102
PHONE: (702) 486-2650
FAX (702) 486-2660
EMAIL: PUBLICWORKS@LABOR.NV.GOV

2025 PREVAILING WAGE RATES WASHOE COUNTY REGION

DATE OF DETERMINATION: October 1, 2024

**APPLICABLE FOR PUBLIC WORKS PROJECTS OVER \$100,000 BID/AWARDED
OCTOBER 1, 2024 THROUGH SEPTEMBER 30, 2025**

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.

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Bricklayer.....	7
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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
Floor Coverer.....	19
Glazier	20
Highway Striper	22
Hod Carrier-Brick Mason	23
Hod Carrier – Plasterer Tender.....	24
Ironworker.....	26
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Operating Engineer – Steel Fabricator & Erector.....	35
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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.....	77.37
Air Balance Technician-Foreman.....	82.06
Air Balance Technician-General Foreman.....	86.75

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.....	74.61
Boilermaker Foreman.....	78.59

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 less 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

Bricklayer Journeyman.....	53.96
Bricklayer Foreman.....	55.21

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.....	61.42
Carpenter Foreman.....	65.26
Carpenter General Foreman.....	69.48

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.....	54.42
Cement Mason - Foreman.....	58.92

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 (coilable 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.....	73.88
Wireman-Cable Splicer.....	78.33
Wireman Foreman.....	79.95
Wireman General Foreman.....	86.02

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.....	126.41
Elevator Constructor-Journeyman Mechanic In Charge.....	137.32

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 Local 8.

The handling and unloading of all equipment coming under the jurisdiction of the Elevator Constructor, from the time such equipment arrives at or near the building site, shall be handled and unloaded by the Elevator Constructors. Mechanical equipment such as a forklift or truck mounted swing boom may be used by the Elevator Constructors. A derrick, crane or material hoist can be used under the supervision of Elevator Constructors to handle and unload the heavy material 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.
- (l) 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.....51.03

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.....48.91

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.....	60.65
Floor Coverer Foreman.....	64.49

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.....	33.96
Glazier Foreman.....	36.41
Glazier Superintendent.....	37.63

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.....	53.53
Highway Striper Foreman.....	54.03

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 mid night 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.....	51.28
Brick Mason Foreman.....	51.68

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
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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.....	51.62
Plasterer Tender- Gun Tender.....	52.62
Plasterer Tender-Foreman.....	52.98

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
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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 trowled 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, tusk 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

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 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, Admission (Nevada) Day, Veterans 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, cinder machines, pelletizing machines, reactor vessels, reactor spheres, completed tanks and assembled sections of completed tanks, scroll cases, refineries, hydroelectric power houses and steam plants, cogeneration plants, vessels and government departments; false work, travelers, scaffolding, pile drivers, sheet piling, derricks and powered derrick swinger including the erection, installation, handling and operating. Cranes erection, installation, handling and operating of same on all forms and types of construction work. The operation of Valla and Spider type battery and/or propane powered portable floor cranes having no operator seat utilized to install ironworker scope of work and the same on all forms and types of construction work. Crane work at the ports, including hammer-head cranes, container cranes and rubber tire cranes. Offloading, relocations, and commissioning of all burning and removal of sea bracing track layout; erection of apex boom extensions, back reach extensions, and rail replacement. Includes all welding, containment and structural modifications of the aforementioned items; railroad bridge work including maintenance thereof; moving, hoisting and lowering of machinery, modules, skid modules and placing of same on foundation, including bridges, cranes, intermittent use forklifts, derricks, buildings, piers and vessels; loading, unloading, necessary maintenance, erection, installation, removal, wrecking and dismantling of all of the above and all reinforcing work and submarine diving in connection with or about same; erection of steel towers, chutes and spouts for concrete where attached to towers and handling and fastening of cables and guys for same; unloading, racking, sorting, cutting, bending, hoisting, placing and tying including the use of any and all mechanical tying devices, burning and welding including stud welding of all iron, steel and metal in reinforced concrete construction including mesh for floor arches and the making of hoops and stirrups, metal forms and metal supports thereof; jacking of slip forms, installation of all wire, cable, parabolic cans, steel and all other materials, including, but not limited to, composites, carbon fiber and fiberglass, used for the purposes of prestressing including grouting of ducts, post stressing concrete girders, beams, columns, etc.; loading, unloading, hoisting, handling, signaling, placing and erection of all prestressed, post stressed, precast materials, G.F.R.C., Dryvit System, including the securing by bolting and/or welding and the installation of steeltex and wire mesh of any type when used for reinforced concrete construction; erection of all curtain wall; glass handrail; stay in place deck; automated and/or mechanical parking structures; offloading, staging, hoisting and setting of modular structures and micro-units; curtain wall systems and associated sealants. Window wall and entrances, panels, insulated and non-insulated, factory and field assembled, porcelain enameled panels, ceramic, laminated spandrelite, louvers and sunscreens; application of thiokol, neoprene and other sealants used to seal materials installed by Iron Workers; installation and handling of phenolic panels, including but not limited to, Trespa products and all similarly related materials and/or systems; installation of metal window stools and sills; installation of aluminum, bronze and steel thresholds; erection and dismantling of all types of cranes and changing of booms; erection of rock, sand and gravel plants, dismantling and loading out conveyors, aggregate plants, batch plants, ableways, refrigeration plants, etc.; erection and dismantling of Monigan walking dragline, launchhammer bucket wheel excavator and other trenching equipment; signaling on highlines, whirley cranes and derricks, buck hoists, man hoists, fork lifts, material towers and scanning antennae; metal and steel supports of all types; fabrication, assembling and erection of offshore drilling platforms or similar installations; dust collectors, precipitators, multi-plate, specialty welding processes, unloading, loading, hoisting, handling and rigging of all building materials delivered to the job

site; hanging ceilings, tees, channels, beams, acoustical elements, sound barriers, computer floors, etc.; installation of stage rigging (including counterweights), curtains, draperies, traverse rods, tracks, cables, window cleaning equipment, powered work platforms, including and loading and unloading, erection installation and removal of powered chassis mounted elevating mast climbing work platforms, rigging in connection with display shows; ski lifts, etc.; wrecking of bridges, viaducts, elevated roads and structural steel and iron in buildings; all steel frames for openings, all porches, verandas, canopies and balconies; all overhead travelers, duo rails, tram rails; erection, setting, repairing of guard or collision rails on bridges and approaches, road ways or any other structures; handling and setting of all types of steel and metal joists, including metal box joists for truss lab and preformed keystone shaped metal joists; erection of steel and metal houses and packaged buildings; all translucent and plastic material on steel frame construction; the erection of solar energy systems, including but not limited to, photo voltaic, heliostat and parabolic systems, energy producing windmill type towers, wind turbine erection to included, but not limited to, prep work, boltup, tensioning or torque of bolts on base and all tower section turbine and blade assemblies; nuclear reactors, electromagnetic shielding plates and atomic vessels including all component parts; the plumbing, aligning and leveling of all materials and equipment through the use of optical instruments, LASER beams, etc., and the use of instruments to establish layout, installation and disposition of ironworker installed scope of work; the unloading, distributing, stockpiling and handling of all materials coming under the jurisdictional claims of the UNION such as to rail heads, storage yards, loading and unloading, hoisting, handling, signaling of all fabricated material and equipment at the jobsite (except FOB deliveries) related to the Iron Workers jurisdiction that is within the individual employers' contractual scope of work including from and to barge and ships to a lay down yard or construction project, etc., shall be done by the Iron Workers.

All reinforcing work in connection with field fabrication, including but not limited to the pre-assembly of reinforcing cages, loading and unloading, handling, racking, sorting, cutting, bending, hoisting, intermittent use of forklifts, placing, burning, welding and tying of all material including the use of any and all mechanical tying devices, or substitute materials, including but not limited to, composites, carbon fiber and fiberglass, stainless steel, used to reinforce concrete construction shall be done by Iron Workers within the individual employers' scope of work at the jobsite, excluding FOB deliveries. A working Iron Worker shall be employed for maintenance on jobs of substantial size while concrete is being poured on reinforcing steel, wire mesh and paper back steeltex but will not be required as a stand-by man. All work in connection with the installation, alignment, repair & modification of panelized roofing systems, pre-engineered fabric structures, aluminum clarifier coverings, carports, ministorages, and dock planks. All work in connection with the installation, alignment, repair and modification of bleachers, planking and stadium seating. All work in connection of installation of amusement rides including, but not limited to, the erection and alignment of all track, machinery and related components.

Craft: Laborer (Union Rate)

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

Landscaper	45.62
Furniture Mover	47.12
Group 1.....	50.78
Group 1A.....	48.91
Group 2.....	50.88
Group 3.....	51.03
Group 3A.....	54.46
Group 4.....	51.28
Group 4A.....	53.78
Group 5.....	51.58
Group 5A.....	53.53
Group 5A Foreman.....	54.03
Group 6	
Nozzlelemen, Rodmen.....	50.58
Gunmen, Materialmen.....	50.58
Reboundmen.....	50.93
Gunit Foreman.....	51.98

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

No remote area pay shall be paid within ten (10) miles of employee's permanent place of residence in the State of Nevada.

ADD PREMIUM PAY

One and one half (1 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

Lubrication and Service Engineer (mobile and grease rack).....74.93

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.....	78.46
Mechanical Insulator-Foreman.....	82.46
Mechanical Insulator-General Foreman	84.46

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.....	77.11
Millwright Welder.....	80.11
Millwright Foreman.....	81.79
Millwright General Foreman.....	86.93

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, hydropneumatics, 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 assemblies, 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, comminutors, 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 classifier, 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

Operating Engineers	(SEE GROUP CLASSIFICATIONS)
Group 1.....	69.91
Group 1A.....	72.67
Group 2.....	73.20
Group 3.....	73.47
Group 4.....	74.21
Group 5.....	74.51
Group 6.....	74.68
Group 7.....	74.93
Group 8.....	75.52
Group 9.....	75.84
Group 10.....	76.19
Group 10A.....	76.38
Group 11.....	76.62
Group 11A.....	78.26
Group 11B.....	79.07
Foreman.....	78.26
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.....	85.21
Group 1 Truck Crane Oiler.....	79.04
Group 1 Oiler.....	77.08
Group 2.....	83.70
Group 2 Truck Crane Oiler.....	78.79
Group 2 Oiler.....	76.87
Group 3.....	82.46
Group 3 Truck Crane Oiler.....	78.57
Group 3 Oiler.....	76.65
Group 3 Hydraulic.....	78.24
Group 4.....	80.73
Group 5.....	79.63
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

Operating Engineers	(SEE GROUP CLASSIFICATIONS)
Group 1.....	84.68
Group 1 Truck Crane Oiler.....	79.22
Group 1 Oiler.....	77.30
Group 2.....	83.14
Group 2 Truck Crane Oiler.....	79.01
Group 2 Oiler.....	77.10
Group 3.....	81.69
Group 3 Truck Crane Oiler.....	78.79
Group 3 Oiler.....	76.87
Group 4.....	80.18
Group 5.....	79.07
Group 6.....	75.79
Group 7.....	77.00
Group 8.....	76.04
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 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.....	53.14
Spray Painter/Paperhanger.....	55.14
Sandblaster.....	55.14
Structural Steel & Steeplejack.....	51.14
Swing Stage.....	55.64
Special Coating Application-Brush.....	55.14
Special Coating Application-Spray.....	55.14
Special Coating Application-Spray Steel.....	55.14
Foreman.....	\$2.50 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 Painting 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.....	61.92
Piledriver-Welder.....	62.92
Piledriver-Foreman.....	65.81
Piledriver-General Foreman.....	70.09
Tender.....	65.81
Stand-By Diver.....	66.81
Diver-Diving (Wet Pay).....	110.58

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 Drivers 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 cloverleaves, 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.....	55.62
Plasterer-Foreman.....	59.57

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 the first two (2) hours worked over eight (8) hours Monday through Friday. Double the regular straight time rate shall be paid for all hours worked over ten (10) hours Monday through Friday. One and one half (1 ½) the regular straight time rate shall be paid for the first ten (10) hours on Saturday. Double the regular straight time rate shall be paid for all hours worked over ten (10) hours on Saturday. All hours worked on Sunday shall 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 troweled 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.....	76.10
Plumber/Pipefitter-Foreman.....	81.19
Plumber/Pipefitter-General Foreman.....	86.28

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 heating and refrigeration systems and competent parts thereof, including fabrication, assembling, erection installation, dismantling, repairing, reconditioning, adjusting, altering servicing, handling, distributing, and tying on all piping materials appurtenances and equipment by method, including all hangars and supports of every description, all other work including the 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.....	67.14
Refrigeration -Foreman.....	67.64

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 heating and refrigeration systems and competent parts thereof, including fabrication, assembling, erection installation, dismantling, repairing, reconditioning, adjusting, altering servicing, handling, distributing, and tying on all piping materials appurtenances and equipment by method, including all hangars and supports of every description, all other work including the trade relevant to oil burner and all other types of heating and refrigeration equipment including low voltage controls.

Craft: ROOFER (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.....	77.37
Sheet Metal Worker -Foreman.....	82.06
Sheet Metal Worker -General Foreman.....	86.75

ADD ZONE RATE

A separate free zone will be established for employees permanently residing and working within a seventy-five (75) mile radius of the Elko, Nevada Post Office. 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.

Rodman/Chainman	72.97
Instrumentman.....	74.43
Chief of Party Surveyor.....	75.69

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.....	59.26
Taper-Foreman.....	63.53

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.....	42.32
Tile Setter/Terrazzo Worker/Marble Mason - Finisher Foreman.....	44.32
Tile Setter/Terrazzo Worker/Marble Mason Finisher- General Foremen.....	68.32

ADD ZONE RATE

In addition to TILE/TERRAZZO WORKER/MARBLE MASON FINISHER wage rates, employees shall receive the following hourly zone pay for all jobs located more than forty (40) miles from the Washoe County Courthouse in Reno, Nevada:

Zone 1	0 to 40 miles	\$0.00
Zone 2	40 to 50 miles	\$3.75
Zone 3	50 to 70 miles	\$5.00
Zone 4	Over 70 miles	\$10.00

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

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.....	52.37
Tile Setter - Foreman.....	54.37
Tile Setter - General Foreman....	58.37
Terrazzo/Marble Mason - Journeyman	53.87
Terrazzo/Marble Mason - Foreman	55.87
Terrazzo/Marble Mason - General Foreman.....	59.87

ADD ZONE RATE

In addition to TILE SETTER/TERRAZZO/MARBLE MASON wage rates, employees shall receive the following hourly zone pay for all jobs located more than forty (40) miles from the Washoe County Courthouse in Reno, Nevada:

Zone 1	0 to 40 miles	\$0.00
Zone 2	40 to 50 miles	\$3.75
Zone 3	50 to 70 miles	\$5.00
Zone 4	Over 70 miles	\$10.00

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.....50.78

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 yds.....	32.25
Under 8 yds & including 12 yds.....	32.25
Over 12 yds.....	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
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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 weather/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 stabilization components

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 performed 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

- Guniting Foremen, Nozzlemen, Rodmen, Gunmen, Materialmen, Reboundmen

- Tunnel and shaft workers/miners and use of customary tools and equipment for tunnel and mine work All work performed in a compressed air tunnel shaft or chamber including the use of hand, power tools or equipment as necessary in connection with compressed air work
-

OPERATING ENGINEER, includes but is not limited to:

Group 1

- Engineer Assistant

Group 1A

- Oiler (Construction)
- Partsman

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
- Cargy-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
- Cargy 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 Liebherr 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 -PILEDRIIVER**Group 1**

- Derrick Barge Pedestal mounted over 100 tons
- Clamshells over 7 cu. yds.
- Self-Propelled Boom Type Lifting Device, over 100 tons
- Truck Crane or Crawler, land or barge mounted over 100 tons

Group 2

- Derrick Barge Pedestal mounted 45 tons up to and including 100 tons
- Clamshells up to and including 7 cu. yds.
- Self-Propelled Boom Type Lifting Device over 45 tons
- Truck Crane or Crawler, land or barge mounted, over 45 tons up to and including 100 tons

Group 3

- Derrick Barge Pedestal mounted under 45 tons
- Self-Propelled Boom Type Lifting Device 45 tons and under
- Skid/Scow Piledriver, any tonnage
- Truck Crane or Crawler, land or barge mounted 45 tons and under

Group 4

- Assistant Operator in lieu of Assistant to Engineer
- Forklift, 10 tons and over
- Heavy Duty Repairman/Welder

Group 5

No current classification

Group 6

- Deck Engineer

Group 7

No current classification

Group 8

- Deckhand
 - Fireman
-

SECTION 01200 - PROJECT MEETINGS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and procedural requirements for project meetings including, but not limited, to the following:
 - 1. Pre-Construction Conference
 - 2. Pre-Installation Conferences
 - 3. Coordination Meetings
 - 4. Progress Meetings
 - 5. Start-up / Training
 - 6. Service, maintenance, warranty review.
- B. Construction Schedules are specified in Division 1 SECTION 01310-A – PROGRESS SCHEDULES.

1.3 PRE-CONSTRUCTION CONFERENCE

- A. The Contractor shall schedule a pre-construction conference and organizational meeting at the project site or other convenient location no later than fifteen (15) days after execution of the Contract and prior to commencement of any construction activities. The Contractor shall conduct the meeting to review scope, responsibilities, personnel assignments, Permits, submittals, safety, emergency action plans, contacts, schedule, etc.
- B. Attendees: Owner; Architect, and their consultants; Contractor and their Superintendent and major sub-contractors; and manufacturers, suppliers and other concerned appropriate parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Construction schedule

SECTION 01200 - PROJECT MEETINGS

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

SECTION 01200 - PROJECT MEETINGS

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.

SECTION 01200 - PROJECT MEETINGS

- 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.

SECTION 01200 - PROJECT MEETINGS

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:

SECTION 01300 – SUBMITTALS

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.

SECTION 01300 – SUBMITTALS

- 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.

SECTION 01300 – SUBMITTALS

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:

SECTION 01300 – SUBMITTALS

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

SECTION 01300 – SUBMITTALS

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.

SECTION 01300 – SUBMITTALS

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.

SECTION 01300 – SUBMITTALS

- 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

SECTION 01300 – 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.

SECTION 01300 – SUBMITTALS

- 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

SECTION 01310B – PROGRESS SCHEDULES

- 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

SECTION 01310B – PROGRESS SCHEDULES

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.

SECTION 01310B – PROGRESS SCHEDULES

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

SECTION 01310B – PROGRESS SCHEDULES

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.

SECTION 01310B – PROGRESS SCHEDULES

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

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- 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 AAxxxxxx-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.

Area	CSI Spec Section	Unique Identifier
	↓	
AAxxxxxx-01		
 - 3) Each activity shall have a narrative description consisting of a

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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:

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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

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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

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- 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

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- 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.

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- 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.

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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 Contractor's 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.

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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.

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- 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

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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.

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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

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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

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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

SECTION 01310B – PROGRESS SCHEDULES

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.

SECTION 01400 – QUALITY CONTROL

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.

SECTION 01400 – QUALITY CONTROL

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.

SECTION 01400 – QUALITY CONTROL

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.

SECTION 01400 – QUALITY CONTROL

- 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,

SECTION 01420 – REFERENCES

	Department of Transportation, <i>Standard Specifications</i>
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

SECTION 01420 – REFERENCES

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

SECTION 01420 – REFERENCES

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 Directed	A consultant to the Architect Directed by the Architect

SECTION 01420 – REFERENCES

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,	The Owner will furnish at their cost and the Contractor
Contractor-Installed	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

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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

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- 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”.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- 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.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

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.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- 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

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

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.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

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.

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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 Facilities: 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.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- 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 or 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.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

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

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

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.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- 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.

SECTION 01500 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- 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.

SECTION 01600 – MATERIALS AND EQUIPMENT

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.

SECTION 01600 – MATERIALS AND EQUIPMENT

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 contractors.
 - 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

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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

SECTION 01600 – MATERIALS AND EQUIPMENT

- 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.

SECTION 01600 – MATERIALS AND EQUIPMENT

- 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

SECTION 01631 - SUBSTITUTIONS

- 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 Questionnaire (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.

SECTION 01631 - SUBSTITUTIONS

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.

SECTION 01631 - SUBSTITUTIONS

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

SECTION 01631 - SUBSTITUTIONS

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?

SECTION 01631 - SUBSTITUTIONS

7. Describe maintenance requirements for this product and availability of expert repair service, if needed.
8. Will the proposed substitution result in a change in Contract price or time of completion? If so, submit itemization of price change and explain effect on time of completion.
9. Will the use of the proposed product necessitate a change in the contract drawings or specifications?
10. Will the use of this product necessitate the payment of any license fees or royalties?
11. Furnish information establishing financial responsibility of the manufacturer. (Number of years in business, volume of business, Dunn & Bradstreet rating, etc.)
12. The Contractor certifies that he or she understands the conditions of use to which this product will be put and he/she warrants this product as stipulated in the General Conditions.

Name of Contractor

Signature of Officer, Owner or Partner

Date

SECTION 01650 - CONTRACTOR MOVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and supervisory requirements necessary for coordinating construction contractor moving requirements including, but not necessarily limited to, the following:
 - 1. General Project Coordination Procedures
 - 2. Conservation
 - 3. Coordination Drawings
 - 4. Administrative and Supervisory Personnel
 - 5. Cleaning and Protection
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 1 SECTION 01200 – PROJECT MEETINGS for progress meetings and coordination meetings.
 - 2. Division 1 SECTION 01300 - SUBMITTALS for preparing and submitting the Contractor's construction schedule.

1.3 OWNER RESPONSIBILITIES

- A. The Owner shall complete all of the preparatory work required for the moving of furnishings, equipment, files, etc. as listed below:
 - 1. Supply boxes, tape and box labels.
 - 2. All personal property is the responsibility of WCSD.
 - 3. All WCSD property that will fit in the WCSD provided boxes are to be boxed.
 - 4. All file cabinets, desks, shelves and closets are to be emptied.
 - 5. All loose trash shall be picked up and disposed of.

SECTION 01650 - CONTRACTOR MOVING

6. Inform school of time frames and schedules.
7. Coordinate staging area for temporary storage containers with site, as required.
8. All items will be ready to move based upon the Contractor's approved schedule.

1.4 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall be responsible for moving all furnishings, equipment, files, etc. as directed by the Owner and listed above and all of the items as listed:
 1. Hire movers and manage all aspects of the move.
 2. Supply all required moving tools, dollies, hand trucks, carts, etc.
 3. Supply steel lockable temporary storage containers, if required.
 4. Photograph the space prior to moving out.
 5. Replace all items in space as indicated on photographs.
 6. Repair or replace any WCSD owned property damaged by the Contractor.
 7. Disconnect and reconnect, as needed, any computer, audio, copy and print equipment, etc.

1.5 COORDINATION

- A. Coordinate the construction operations included in various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate the construction operations included under different sections that depend on each other for proper installation, connection and operation.
 1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 3. Make provisions to accommodate items scheduled for later installation.

SECTION 01650 - CONTRACTOR MOVING

- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination, include such items as required such as, notices, reports and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of schedules
 - 2. Installation and removal of temporary facilities
 - 3. Delivery and processing of submittals
 - 4. Progress meetings
 - 5. Project closeout activities
- D. Conservation: Coordinate moving operations to assure that operations are carried out with consideration given to conservation of energy, water and materials.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work.
- E. Intent of Drawings:
 - 1. The work of the Contractor and any applicable sub-contractors shall conform to the intent of the architectural and moving coordination work as reviewed by the Architect. Drawings are partly diagrammatic and do not intend to show in detail all features of the work. The Contractor shall carefully review the work to be performed by other trades, compare related drawings and shall thoroughly understand the moving responsibilities affecting their work.
 - 2. All changes required in the work caused by failure to do so shall be at no expense to the Owner.
- F. Moving Coordination Drawings:
 - 1. Floor Plans and Wall Elevations shall include dimensioned sizes and locations for all door and window openings.

SECTION 01650 - CONTRACTOR MOVING

1.6 SUBMITTALS

- A. Coordination Drawings: Prepare moving coordination drawings where careful coordination is needed for installation of products, materials and equipment to be relocated and stored.
 - 1. Show the relationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences. Acknowledge the Contractor's responsibilities in written fashion.
 - 3. Comply with requirements contained in Division 1 SECTION 01300 - SUBMITTALS.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

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

3.2 CLEANING AND PROTECTION

- A. Clean and protect material and equipment during handling and installation. Apply protective covering, where required, to assure protection from damage or deterioration at the time of Substantial Completion.
- B. Clean and provide maintenance on moved and stored work as frequently as necessary through the remainder of the construction period.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the relocated work completed or in progress, is subject to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 - 1. Excessive static or dynamic loading
 - 2. Excessive internal or external pressures

SECTION 01650 - CONTRACTOR MOVING

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

SECTION 01650 - CONTRACTOR MOVING

- 26. Excessive weathering
- 27. Unprotected storage
- 28. Improper shipping or handling
- 29. Theft
- 30. Vandalism

END OF SECTION 01650

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes administrative and procedural requirements for Contract closeout including, but not limited to, the following:

1. Inspection Procedures
2. Submittal of Project Record Document
3. Submittal of Operation and Maintenance Manual
4. Submittal of Warranties
5. Final Cleaning
6. Submittal of Regulated Systems [ACBM (Asbestos Containing Building Materials) & Lead] Closeout Documents
7. Submittal of any Final Prevailing Wage Reports

- B. Closeout requirements for specific construction activities are included in the appropriate sections in Divisions 2 through 16.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show one hundred percent (100%) completion for the portion of the work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the contract sum.
 - b. If one hundred percent (100%) completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

SECTION 01700 - CONTRACT CLOSEOUT

- c. Provide a list of all warranties, provide warranty duration, complete contract information of firm, and name of individual who will be performing work – post one (1) year. extended warranties will be submitted on a separate spread sheet within the closeout documents in the following format. Specification #, Company responsible for performing the warranty work, Local contact for responsible individual, phone number and email address, warranty description, warranty period, warranty start and end dates.
 2. Advise the Owner of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities.
 5. Include occupancy permits, operating certificates, and similar releases.
 6. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
 7. Submit all required training meeting minutes and video recordings of all training courses.
 8. Deliver tools, spare parts, extra stock, and similar items.
 9. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
 10. Complete startup testing of systems and videoed training instruction of/for the Owner's Operation and Maintenance personnel.
 11. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
 12. Complete final clean-up requirements, including touch up painting.
 13. Touch-up and otherwise repair and restore marred, exposed finishes.
- 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.

SECTION 01700 - CONTRACT CLOSEOUT

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.

SECTION 01700 - CONTRACT CLOSEOUT

1. Upon completion of reinspection, the Architect will prepare a Certificate of Final Acceptance. If the work is incomplete, the Architect will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set black line white prints of Contract Drawings and Shop Drawings or continuous live electronic as built drawings with appropriate mark ups. Mark the set to show the actual installation where the installation varies from the work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. At the conclusion of the project, this record set of prints shall be submitted to the Architect for his/her review and comment. If the record set of prints is found to be complete and accurate, the prints shall be returned to the Contractor for submittal to the Owner with other closeout documents.

Record drawings must be reviewed and approved prior to each pay request by the Owner's representative. The drawings should reflect the work that has been accomplished during the time period of the pay request. Lack of record drawings approval at the time of submittal of a pay request will result in a potential delay in the processing of the pay request.

1. Mark record sets with red erasable pencil or electronic. Use other colors to distinguish between variations in separate categories of work.
2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
3. Note related change order numbers where applicable.
4. Organize record drawing sheets into manageable sets.
5. Provide one Bound set of record drawings with durable paper cover sheets; print suitable titles, dates and other identification on the cover of each set.

SECTION 01700 - CONTRACT CLOSEOUT

6. . Provide record drawings using electronic media, including one PDF and one Auto Cad compatible. Original media will be provided for Contractor to make required record drawing notations.

- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual, one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.

Record specifications must be reviewed and approved prior to each pay request by the Owner's representative. The specifications should reflect the work that has been accomplished during the time period of the pay request. Lack of record specification approval at the time of submittal of a pay request will result in a potential delay in the processing of the pay request.

1. Mark these documents to show substantial variations in actual work performed in comparison with the text of the specifications and modifications.
2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
3. Note related record drawing information and product data.
4. Upon completion of the work, submit an electronic record specifications to the Architect for the Owner's records.

- D. Record Product Data: Maintain one (1) copy of each Product Data submittal. Note related Change Orders and markup of record drawings and specifications.

1. Mark these documents to show significant variations in actual work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
2. Give particular attention to concealed products and portions of the work that cannot otherwise be readily discerned later by direct observation.
3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.

- E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the project site to determine which samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's sample storage area.

SECTION 01700 - CONTRACT CLOSEOUT

F. Miscellaneous Record Submittals: Refer to other specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or electronic file, ready for continued use and reference. Submit to the Architect for the Owner's records.

G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind 2 copies (1 hard copy / 1 electronic) properly indexed data in individual, heavy duty, 2-inch, 3-ring, vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions
2. Spare parts list
3. Copies of warranties
4. Wiring diagrams
5. Recommended turn around cycles
6. Inspection procedures
7. Shop Drawings and Product Data
8. Fixture lamping schedule
9. Any other applicable information

H. Warranty Manuals: organize warranty data into suitable set of manageable size, Bind 1 copy and 1 electronic properly indexed in individual, heavy duty 3 ring binder. Mark appropriate identification on front and spine. Include the following types of information:

1. All products with extended warranties beyond 1 year, including duration (start and end date, similar to what is described in 1.3, A, 1,c)
2. Manufacturer
3. Model / Serial where applicable
4. Manufacturer contact information

SECTION 01700 - CONTRACT CLOSEOUT

- I. Provide one complete download of all Procore Files properly organized and linked in PDF versions. Contractor to ensure original Procore file and documentation remains in place on Procore for use by owner. Owner shall instruct the contractor of the proper file structure

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Film Document each training and demonstration. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
 1. Maintenance manuals
 2. Record documents
 3. Spare parts and materials
 4. Tools
 5. Lubricants
 6. Fuels
 7. Identification systems
 8. Control sequences
 9. Hazards
 10. Cleaning
 11. Warranties and bonds
 12. Maintenance agreements and similar continuing commitments
- B. As part of instruction for operating equipment, demonstrate the following procedures:
 1. Start-up

SECTION 01700 - CONTRACT CLOSEOUT

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

SECTION 01710 - FINAL CLEANING

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.

SECTION 01710 - FINAL CLEANING

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.

SECTION 01710 - FINAL CLEANING

- 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

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

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.

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

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

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

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.)

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

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

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

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.

SECTION 01 91 13 – GENERAL COMMISSIONING REQUIREMENTS

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).

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- 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. It is the General Contractor's responsibility to obtain permission from the Architect to use the Architect's Revit model for the purpose of BIM modeling. The BIM modeling process will be solely managed by the General Contractor but shall work in conjunction with all subcontractors that are relevant to the process. The General Contractor shall thoroughly study the conformed contract drawings to completely understand the project intent as well illustrating to the Owner/Architect of any cost or no cost corrections to the contract drawings prior to starting the BIM process. An engineer/architect revision shall be issued if these changes alter the original intent of the Drawings. The Owner shall not entertain any additional VDC costs based on misunderstanding or lack of clarity of the contract drawings and specifications.
- E. 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

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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

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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.

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- 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.

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- 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

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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.

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- 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-Appendix 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.

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- 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 met 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

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- 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

Washoe County School District Transportation Yard Modernization

CDS Project No. 202211



Bid Set Project Manual Volume I Divisions 00-14

*1980 Kleppe Lane
Sparks, NV 89431
20 September, 2024*

COLLABORATIVE
DESIGN
STUDIO *architecture of experience and place*

WCSD Central Transportation Yard Modifications - Sparks, Nevada
Collaborative Design Studio Project No. 202211

BID SET
15 August, 2024

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Refer to Drawings for other Sections

DIVISION 33 – UTILITIES

Refer to Drawings

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SECTION 017510 – ELECTRICAL SYSTEMS COMMISSIONING

PART 1 – GENERAL

1.1 GENERAL

- A. The electrical systems commissioning shall include a demonstration by the Contractor that all electrical equipment and/or systems, all emergency power equipment, and all lighting controls have been installed, configured, and tested in conformance with the project specifications. The commissioning process shall demonstrate that each electrical system component has been properly installed and that the associated electrical test data corresponds with the requirements of the contract documents. The electrical contractor (along with any other necessary parties) shall complete a 'pre-commissioning checkout' and shall certify in writing that all electrical systems and equipment have been verified to be operating in accordance with the requirements stated in the contract documents prior to requesting date(s) for the final on-site electrical systems commissioning session(s).
- B. The Contractor shall schedule an electrical systems pre-commissioning meeting with the Owner's representatives at least four weeks prior to beginning testing and check-out of the electrical systems and equipment. This meeting will be utilized to review and discuss specific testing requirements and/or procedures (including any required third-party electrical systems testing) and to discuss the anticipated timeframe(s) for conducting the testing and commissioning.
- C. Electrical systems commissioning shall be conducted with representatives from the following entities (the required participants shall be confirmed with the SPWD prior to scheduling the commissioning sessions):
 - 1. General Contractor (with a complete set of plans, specifications, and addenda).
 - 2. Electrical Contractor (with a complete set of electrical equipment operating and maintenance manuals and with test instruments as required to perform all specified testing/verification).
 - 3. Factory-authorized technicians for all major equipment (emergency generators, automatic transfer switches, uninterruptible power supplies, lighting controls, fire and/or security systems, etc.).
 - 4. SPWD's designated representative.
 - 5. Electrical Design Engineer (as necessary).
 - 6. Third party commissioning agent (when applicable).
 - 7. The aforementioned representatives shall be present during all portions of the testing (and re-testing as required) and shall be equipped to promptly remedy any deficiencies observed during the commissioning process.

8. 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 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 work that is found to be in non-compliance with the requirements of this specification and/or in non-compliance with the remainder of the contract documents.
9. The Contractor shall include adequate time periods for all commissioning tasks in the project schedule. The necessary time periods shall be carefully reviewed with all of the appropriate subcontractors to ensure that the subcontractors are in agreement with the time allotted for each scheduled task.
10. The Contractor shall assist the Owner and/or the third party testing agency by facilitating all required tests and inspections such that the Owner and/or testing agency performs testing and verification only.
11. Successful completion of the entire electrical systems commissioning process shall be a condition of Substantial Completion. The building shall be considered 'ready to utilize for its intended use' only at such time that the entire electrical systems commissioning scope of work is successfully completed and accepted by the Owner.

1.2 EMERGENCY GENERATOR TESTING

- A. The Contractor shall provide resistive load bank(s) with associated controls as required to perform the specified load tests. During cold start testing the generator shall reach 90% of rated voltage and frequency within 10 seconds. During recovery testing the generator shall reach 90% of rated voltage and frequency within 2 seconds. The generated voltage shall not drop below 85% of the rated voltage during any portion of the generator load testing (part or full load testing). See Division 26 specifications for additional generator testing requirements. Minimum load testing shall be as follows:

1. 25%, 50%, and 75% of rated load for 30 minutes each.
2. 100% of rated load for 3 hours.
3. Recovery test in a single step from no load to 100% of rated load.

The voltage, frequency, load current, kW, oil pressure, coolant temperature, and the ambient air temperature shall be recorded during 15 minute intervals during the emergency generator test procedures.

- B. All tested values shall be in accordance with the generator manufacturer's published performance data.

1.3 ELECTRICAL SYSTEMS COMMISSIONING CHECKLIST

- A. Verify clearances at all electrical equipment, panelboards, switchboards, and motor control centers.
- B. Verify labeling of all equipment, panelboards, switchboards, motor control centers, and wiring.
- C. Verify installation of housekeeping pads for all electrical equipment.
- D. Verify anchoring of all electrical equipment.
- E. Test torquing of wire terminations and bussing.
- F. Verify all fuse ratings, all circuit breaker ratings, and all thermal overload protection settings.
- G. Verify that conductor color coding is in compliance with specifications and applicable codes.
- H. Test automatic lighting controls (and any associated software/programming).
- I. Test polarity and function of all receptacles.
- J. Test location and function of all GFCI's and other safety devices.
- K. Verify implementation of short circuit and/or coordination studies.
- L. Test operation of emergency generator and automatic transfer switch.
- M. Test operation of uninterruptible power supply (when applicable).
- N. Test operation of building security system.
- O. Test operation of fire alarm system, emergency egress, emergency exit lighting systems and emergency generator. This testing or verification process is to be completed by the State and the Nevada State Fire Marshal Division.**

Note: This checklist is intended to serve only as a guide to typical items that require verification on each project. The actual checklist for each project (typically distributed for review and confirmation at the pre-commissioning meeting) will be expanded as deemed necessary to appropriately test all of the functions and features of the specified electrical systems on each particular project.

END OF SECTION 017510

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of buildings and site improvements.
 - 2. Removing below-grade construction.
 - 3. Disconnecting, capping or sealing, and removing site utilities.
 - 4. Salvaging items for reuse by Owner.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for use of the premises and phasing requirements.
 - 2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
 - 3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.
 - 5. Review procedures for dust control.
 - 6. Review procedures for protection of adjacent buildings.
 - 7. Review items to be salvaged and returned to Owner.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.
- C. Schedule of Building Demolition Activities: Indicate the following:
 - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - 2. Temporary interruption of utility services.
 - 3. Shutoff and capping or re-routing of utility services.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.7 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before building demolition, Owner will remove the following items:
 - a. Equipment scheduled for reuse.
- D. Hazardous Materials: Present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

E. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

2.2 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Salvaged Items: Comply with the following:
 1. Clean salvaged items of dirt and demolition debris.

2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 1. Arrange to shut off utilities with utility companies.
 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 3. Cut off pipe or conduit to the mainline. Cap, valve, or plug and seal at the mainline according to requirements of authorities having jurisdiction.
 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."
 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain fire watch during and for duration required by AHJ after flame-cutting operations.
 - 3. Maintain adequate ventilation when using cutting torches.
 - 4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
 - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated on Drawings, including, but not limited to:
 - 1. Exterior round concrete patio table and benches with associated plaque.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, completely.
- E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.7 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.10 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel reinforcement bars.
 - 2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of steel reinforcement.
 - 2. Bar supports.
 - 3. Mechanical splice couplers.
- B. Shop Drawings: Comply with ACI SP-066:
 - 1. Include placing drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
 - 1. Location of construction joints is subject to approval of Architect.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
 - 1. Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
- C. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
 - 2. Mechanical splice couplers.
- D. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- F. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.

2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
 2. Stagger splices in accordance with ACI 318 (ACI 318M).
 3. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches (305 mm).
 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.
 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 1. Place joints perpendicular to main reinforcement.
 2. Continue reinforcement across construction joints unless otherwise indicated.
 3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117 (ACI 117M).

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
 1. Steel-reinforcement placement.
 2. Steel-reinforcement mechanical splice couplers.
 3. Steel-reinforcement welding.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, and other pozzolans materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

- A. Product Data: For each of the following.
 - 1. Portland cement.
 - 2. Fly ash.
 - 3. Slag cement.
 - 4. Blended hydraulic cement.
 - 5. Aggregates.
 - 6. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
 - 7. Vapor retarders.
 - 8. Liquid floor treatments.
 - 9. Curing materials.
 - 10. Joint fillers.
- B. Design Mixtures: For each concrete mixture, include the following:
 - 1. Mixture identification.
 - 2. Minimum 28-day compressive strength.
 - 3. Durability exposure class.
 - 4. Maximum w/cm.
 - 5. Calculated equilibrium unit weight, for lightweight concrete.
 - 6. Slump limit.
 - 7. Air content.
 - 8. Nominal maximum aggregate size.

9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Vapor retarders.
5. Joint-filler strips.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:

C. Research Reports: For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

D. Preconstruction Test Reports: For each mix design.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.
 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.8 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M).

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Cementitious Materials:
 1. Portland Cement: ASTM C150/C150M, Type I ,.
 2. Fly Ash: ASTM C618, Class C or F.
 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 1M coarse aggregate or better, graded. Provide aggregates from a single source.
 1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. (2.37 kg/cu. m) for moderately reactive aggregate or 3 lb./cu. yd. (1.78 kg/cu. m) for highly reactive aggregate, when tested in accordance with ASTM C1293 and

categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301 (ACI 301M).

2. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Lightweight Aggregate: ASTM C330/C330M, 1-inch (25-mm) nominal maximum aggregate size.
- D. Air-Entraining Admixture: ASTM C260/C260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 2. Retarding Admixture: ASTM C494/C494M, Type B.
 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils (0.25 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Barrier-Bac; Inteplast Group.
 - b. Fortifiber Building Systems Group.
 - c. Foxfire Enterprises, Inc.
 - d. ISI Building Products.
 - e. Poly-America, L.P.
 - f. Raven Industries, Inc.
 - g. Reef Industries, Inc.
 - h. Stego Industries, LLC.
 - i. Tex-Trude.
 - j. W. R. Meadows, Inc.

2.4 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ChemMasters, Inc.
 - b. ChemTec International.
 - c. Concrete Sealers USA.

- d. Curecrete Distribution Inc.
- e. Dayton Superior Corporation.
- f. Euclid Chemical Company (The); an RPM company.
- g. Kaufman Products, Inc.
- h. Laticrete International, Inc.
- i. MAPEI Corporation.
- j. Master Builders Solutions.
- k. NewLook International, Inc.
- l. Nox-Crete Products Group.
- m. PROSOCO, Inc.
- n. Penetron International, Ltd.
- o. SINAK.
- p. Solomon Colors Inc.
- q. SpecChem, LLC.
- r. Specialty Products Group.
- s. US SPEC, Division of US MIX Company.
- t. V-Seal Concrete Sealers & Specialty Coatings.
- u. Vexcon Chemicals Inc.
- v. W. R. Meadows, Inc.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
 - 1. Color:
 - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
 - b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
 - c. Ambient Temperature Above 85 deg F (29 deg C): White.
- C. Curing Paper: 8-feet- (2438-mm-) wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- D. Water: Potable or complying with ASTM C1602/C1602M.
- E. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anti-Hydro International, Inc.
 - b. ChemMasters, Inc.
 - c. Dayton Superior Corporation.
 - d. Euclid Chemical Company (The); an RPM company.
 - e. Kaufman Products, Inc.
 - f. Lambert Corporation.
 - g. Laticrete International, Inc.
 - h. Master Builders Solutions.
 - i. Metalcrete Industries.

- j. Nox-Crete Products Group.
- k. PROSOCO, Inc.
- l. SpecChem, LLC.
- m. TK Products Construction Coatings, a Fenix Group SPC Company.
- n. Vexcon Chemicals Inc.
- o. W. R. Meadows, Inc.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

2.7 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).
 - 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 - 2. Slag Cement: 50 percent by mass.
 - 3. Total of Fly Ash or Other Pozzolans, Slag Cement: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass.
 - 4. Total of Fly Ash or Other Pozzolans: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs concrete for parking structure slabs, and concrete with a w/cm below 0.50.

2.8 CONCRETE MIXTURES

- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
 - 1. Exposure Class: ACI 318 (ACI 318M) S0 .
 - 2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 3. Maximum w/cm: 0.50 .
 - 4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
- B. Class B: Normal-weight concrete used for slab on grade.
 - 1. Exposure Class: ACI 318 (ACI 318M) S0 .
 - 2. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 3. Maximum w/cm: 0.50 .

4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
- C. Class C: Normal-weight concrete used for exterior concrete.
1. Exposure Class: ACI 318 (ACI 318M) F1 .
 2. Minimum Compressive Strength: 4500 psi (31 MPa) (27.6 MPa) at 28 days.
 3. Maximum w/cm: 0.45 .
 4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.2 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 2. Face laps away from exposed direction of concrete pour.
 3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
 4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

3.3 JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
 1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
 3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
 1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.

2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.

- c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.5 FINISHING FORMED SURFACES

- A. As-Cast Surface Finishes:
 - 1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1 inch (25 mm).
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
 - e. Apply to concrete surfaces not exposed to public view.
 - 2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
 - b. Remove projections larger than 1/4 inch (6 mm).
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 (ACI 117M) Class B.
- B. Related Unformed Surfaces:
 - 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
 - 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.6 FINISHING FLOORS AND SLABS

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
 2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.
 3. Apply scratch finish to surfaces to receive concrete floor toppings.
- C. Float Finish:
1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 2. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 (ACI A117M) tolerances for conventional concrete.
 3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- D. Trowel Finish:
1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 4. Do not add water to concrete surface.
 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
 6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 7. Slabs-on-Grade upper surface shall meet the following requirements per ASTM E 1155.
 - a. Site Flatwork
 - 1) F/f greater than or equal to 20
 - 2) F/L greater than or equal to 15
 - b. Interior Slabs on Grade:
 - ~~1) F/f greater than or equal to 25~~
 - ~~2) F/L greater than or equal to 20~~
 - 1) **Specified Overall Value = FF 35 / FL 25**
 - 2) **Minimum Local Value = FF 21 / FL 15**
 - c. Elevated slabs:
 - 1) **Specified Overall Value = FF 35**
 - 2) **Minimum Local Value = FF 21**
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 2. Coordinate required final finish with Architect before application.

- F. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps as indicated on Drawings
 - 1. Apply in accordance with manufacturer's written instructions and as follows:
 - a. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications.
 - b. Tamp aggregate flush with surface, but do not force below surface.
 - c. After broadcasting and tamping, apply float finish.
 - d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.7 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
 - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 - 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 - 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 - 2. Construct concrete bases 4 inches (100 mm) high unless otherwise indicated on Drawings, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
 - 1. Cast-in inserts and accessories, as shown on Drawings.
 - 2. Screed, tamp, and trowel finish concrete surfaces.

3.8 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
 2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 3. If forms remain during curing period, moist cure after loosening forms.
 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:
1. Begin curing immediately after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.

- a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive Polished Finish: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- d. Floors to Receive Chemical Stain:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
 - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
 - 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
 - 4) Leave curing paper in place for duration of curing period, but not less than 28 days.

- e. Floors to Receive Urethane Flooring:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches (150 mm) and sealed in place.
 - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
 - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- f. Floors to Receive Curing Compound:
 - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.
 - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
- g. Floors to Receive Curing and Sealing Compound:
 - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.9 TOLERANCES

- A. Conform to ACI 117 (ACI 117M).

3.10 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.
 - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 - 2. Do not apply to concrete that is less than 28 days' old.
 - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
 - 4. Rinse with water; remove excess material until surface is dry.
 - 5. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
 - 1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
 - 2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 - 3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
 - 1. Headed bolts and studs.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
 - 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 - 6. Batch Plant Inspections: On a random basis, as determined by Architect.

- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
 6. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 7. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and laboratory cure two sets of two 6-inch (150 mm) by 12-inch (300 mm) or 4-inch (100 mm) by 8-inch (200 mm) cylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
 8. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test

- value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 12. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength to be in accordance with ACI 301 (ACI 301M), Section 1.6.6.3.
 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 (ASTM E1155M) within 72 hours of completion of floor finishing and promptly report test results to Architect.

3.12 PROTECTION

- A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
 2. Diaper hydraulic equipment used over concrete surfaces.
 3. Prohibit vehicles from interior concrete slabs.
 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 5. Prohibit placement of steel items on concrete surfaces.
 6. Prohibit use of acids or acidic detergents over concrete surfaces.
 7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
 8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Decorative concrete masonry units.
 - 3. Pre-faced concrete masonry units.
 - 4. Steel reinforcing bars.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
- C. Samples: For each type and color of the following:
 - 1. Exposed CMUs.
 - 2. Pre-faced CMUs.
 - 3. Pigmented and colored-aggregate mortar.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product. For masonry units, include data on material properties and material test reports substantiating compliance with requirements.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 - 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

1.5 FIELD CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Insulated CMUs: Where indicated, units contain rigid, specially shaped, molded-polystyrene insulation units complying with ASTM C578, Type I, designed for installing in cores of masonry units.
 - 1. Acceptable Manufacturer: Concrete Products Group. Contact: Bill Dawson, Toll Free Tel: 800-789-0872; Email: bdawson@concreteproductsgroup.com www.concreteproductsgroup.com Basalite Concrete Products LLC.
 - a) Basalite Concrete Products, LLC, Dixon, CA, www.basalite.com
 - b) Orco Block Co., Inc., Stanton, CA, www.orco.com
 - c) Western Materials., Yakima, WA, www.westernmaterials.com

2. Basis-of-Design Product: HI-R-H

- C. CMUs: ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
- D. Concrete Building Brick: ASTM C55.
- E. Integral Water Repellent Concrete Masonry Units: Provide all exterior wall architectural concrete masonry units, including single wythe walls and facing units, containing the

manufacturer's recommended type and amount of an integral polymeric water repellent admixture.

- F. Color and Finish: As shown on Drawings.
- G. Special shapes:
 - 1. Provide watertables, sills and other special shapes as indicated.

2.3 CONCRETE LINTELS

- A. Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cemex S.A.B. de C.V.
 - b. Holcim (US) Inc.
 - c. Lafarge North America Inc.
 - d. Lehigh Hanson; HeidelbergCement Group.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Davis Colors.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Lanxess Corporation.
 - d. Solomon Colors Inc.
- F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Colored Portland Cement-Lime Mix:
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Holcim (US) Inc.
 - 2) Lafarge North America Inc.
 - 3) Lehigh Hanson; HeidelbergCement Group.
 2. Colored Masonry Cement:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cemex S.A.B. de C.V.
 - 2) Essroc.
 - 3) Holcim (US) Inc.
 - 4) Lafarge North America Inc.
 - 5) Lehigh Hanson; HeidelbergCement Group.
- G. Aggregate for Mortar: ASTM C144.
 1. White-Mortar Aggregates: Natural white sand or crushed white stone.
 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- H. Aggregate for Grout: ASTM C404.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Euclid Chemical Company (The); an RPM company.
 - b. GCP Applied Technologies Inc.
- J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACM Chemistries.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. GCP Applied Technologies Inc.
 - d. Master Builders Solutions.
- K. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Heckmann Building Products, Inc.
 - b. Hohmann & Barnard, Inc.

c. Wire-Bond.

- C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
 - 1. Interior Walls: Mill- galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
 - 5. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
 - 6. Provide in lengths of not less than 10 feet (3 m).

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
 - 2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 - 3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized-steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.35-mm-) diameter, hot-dip galvanized-steel wire.
- C. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.35-mm-) diameter, hot-dip galvanized-steel wire.
 - 3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from 0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.
- D. Partition Top Anchors: 0.105-inch- (2.66-mm-) thick metal plate with a 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M Epoxy coating 0.020 inch (0.51 mm) thick.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or PVC.
- B. Preformed Control-Joint Gaskets: Made from and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.8 MASONRY-CELL FILL

- ~~A. Loose-Fill Insulation: Perlite complying with ASTM C549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).~~
- B. Lightweight-Aggregate Fill: ASTM C331/C331M.

2.9 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use masonry cement mortar unless otherwise indicated.
 3. For exterior masonry, use masonry cement mortar.
 4. For reinforced masonry, use masonry cement mortar.
 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 1. For masonry below grade or in contact with earth, use Type S.
 2. For reinforced masonry, use Type S.
 3. For mortar parge coats, use Type S.
 4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 5. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product.

1. Pigments do not exceed 10 percent of portland cement by weight.
 2. Pigments do not exceed 5 percent of masonry cement by weight.
 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
 - b. Pre-faced CMUs.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
1. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
 - b. Pre-faced CMUs.
- F. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C476, Table 1 .
 3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured in accordance with ASTM C143/C143M.

2.10 INTEGRAL INSULATION

- A. **Integral Insulation: Korfil Molded rigid insulation insert for use with Hi-R-H blocks at 3-1/2" thickness.**
1. **Provide XPS foam rigid insulation infill at corners to maintain line of insulation.**

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.
- B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- F. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 1. Bed face shells in mortar and make head joints of depth equal to bed joints.

2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
 1. Space reinforcement not more than 16 inches (406 mm) o.c.
 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.7 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar

- and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
- 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.8 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level B in TMS 402/ACI 530/ASCE 5.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
- E. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.
- F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- G. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for compressive strength.
- H. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.
- I. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 28 days.

3.9 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch (19 mm). Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot (3 mm per 300 mm). Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.10 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 - 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.11 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete masonry units.
 - 2. Mortar materials.
 - 3. Accessories.
 - 4. Mortar mixes.
- B. Related Requirements:
 - 1. Section 014339 "Mockups" for integrated exterior mockup requirements.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.5 INFORMATIONAL SUBMITTALS

- A. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
- B. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.

2. Testing Agency: Qualified in accordance with ASTM C1093 for testing indicated.

1.7 MOCKUPS

- A. Wall Mockups: Build mockups to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for installation. See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.
 1. Build mockups for each type of exposed unit masonry construction, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches (406 mm) long in mockup.
 2. Protect accepted mockups from the elements with weather-resistant membrane.
 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches (610 mm) down face of veneer, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. For exposed masonry units and cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

2.3 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- B. Integral Water Repellent: Provide units made with integral water repellent.
 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.

- C. Decorative CMUs: ASTM C90, normal weight.
 - 1. Size: Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.
 - a. 4 inches wide by 8 inches high by 16 inches long
 - 2. Pattern and Texture: Standard pattern, split-face finish.
 - 3. Colors: Basalite 111

2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Cement: ASTM C1329/C1329M.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
- E. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Colored Portland Cement-Lime Mix:
 - 2. Colored Masonry Cement:
 - 3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
- F. Aggregate for Mortar: ASTM C144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch (6.4 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
 - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
- I. Water: Potable.

2.5 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
 - 3. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 (Z180) zinc coating.
 - 4. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

2.6 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

2.7 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C270, [Proportion] [Property] Specification. Use Type N unless another type is indicated.
- C. Pigmented Mortar: Use colored cement product.
 - 1. Application: Use pigmented mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (13 mm) or minus 1/4 inch (6.4 mm).
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (13 mm).
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6.4 mm) in a story height or 1/2 inch (13 mm) total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.6 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm).
 - 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3.2 mm).

3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (10 mm) or minus 1/4 inch (6.4 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3.2 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.6 mm) from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (102-mm) horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- B. Lay CMUs with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.
 1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 1. For glazed masonry units, use a nonmetallic jointer 3/4 inch (19 mm) or more in width.

3.6 EXPANSION JOINTS

- A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

- B. Form expansion joints as follows:
 - 1. Build in compressible joint fillers where indicated.

3.7 LINTELS

- A. Install steel lintels where indicated.
- B. Provide offset angle supports where indicate and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are indicated without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (203 mm) at each jamb unless otherwise indicated.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level 2 in TMS 402.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Testing Prior to Construction: One set of tests.
- D. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
- F. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for **[mortar air content] [and] [compressive strength]**.

3.9 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.10 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than 4 inches (102 mm) in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 3. Do not dispose of masonry waste as fill within 18 inches (457 mm) of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042613

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural steel.
 - 2. Shear stud connectors, shop welded.
 - 3. Shrinkage-resistant grout.
- B. Related Requirements:
 - 1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Structural-steel materials.
 - 2. High-strength, bolt-nut-washer assemblies.
 - 3. Shear stud connectors.
 - 4. Anchor rods.
 - 5. Threaded rods.
 - 6. Forged-steel hardware.
 - 7. Shop primer.
 - 8. Galvanized-steel primer.
 - 9. Etching cleaner.
 - 10. Galvanized repair paint.
 - 11. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Mill test reports for structural-steel materials, including chemical and physical properties.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 360.
 - 3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
 - 1. Connection designs have been completed and connections indicated on the Drawings.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles, M-Shapes, S-Shapes: ASTM A36/A36M.
- C. Plate and Bar: ASTM A36/A36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade B structural tubing.
- E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 - 1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH

(ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1 (Type 10.9-1), compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
1. Finish: Hot-dip or mechanically deposited zinc coating.
 2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
1. Finish: Plain.
- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

- A. Unheaded Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55, weldable.
1. Configuration: Straight.
 2. Finish: Plain .
- B. Headed Anchor Rods: ASTM F1554, Grade 36 or ASTM F1554, Grade 55, weldable, straight.
1. Finish: Plain .
- C. Threaded Rods: ASTM A36/A36M or ASTM A193/A193M, Grade B7.
1. Finish: Plain .

2.5 FORGED-STEEL STRUCTURAL HARDWARE

- A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.

2.6 PRIMER

- A. Steel Primer:
1. Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
 2. SSPC-Paint 23, latex primer.
 3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.7 SHRINKAGE-RESISTANT GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.8 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
- B. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

2.9 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened .
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.10 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.11 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces unless indicated to be painted.
 - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7 (WAB)/NACE WAB-4.
4. SSPC-SP 6 (WAB)/NACE WAB-3.

- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.12 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.
 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.
 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M.
 5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

3.3 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 - 1. Joint Type: Snug tightened .
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
 - 1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E164.
 - 4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
 - 2. Composite floor deck.
 - 3. Noncomposite form deck.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Roof deck.
 - 2. Composite floor deck.
 - 3. Noncomposite form deck.
- 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Certificates:
 - 1. Welding certificates.
 - 2. Product Certificates: For each type of steel deck.
- B. Test and Evaluation Reports:
 - 1. Product Test Reports: For tests performed by a qualified testing agency, indicating that power-actuated mechanical fasteners comply with requirements.
 - 2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.
- C. Field Quality-Control Submittals:
 - 1. Field quality-control reports.
- D. Qualification Statements: For welding personnel and testing agency.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding code:
 - a. AWS D1.3/D1.3M.
- B. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its "RoofNav" for Class 1 fire rating and windstorm ratings. Identify materials with FM Approvals Certification markings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in accordance with SDI MOC3. 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 in accordance with AISI S100.
- B. Fire-Resistance Ratings: Comply with ASTM E119; 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 listings of another qualified testing agency.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Steel Deck; ASC Profiles, LLC.
 - 2. New Millennium Building Systems, LLC.
 - 3. Verco Decking, Inc.; a Nucor company.
 - 4. Vulcraft Group; Division of Nucor Corp.
 - 5. Vulcraft/Verco Group; a division of Nucor Corp.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard Gray].
 - 2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
 - 3. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard .
 - 4. Deck Profile: As indicated .
 - 5. Profile Depth: As indicated .
 - 6. Design Uncoated-Steel Thickness: As indicated .
 - 7. Span Condition: Triple span or more.
 - 8. Side Laps: Interlocking seam.

2.3 COMPOSITE FLOOR DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Steel Deck; ASC Profiles, LLC.
 - 2. New Millennium Building Systems, LLC.
 - 3. Verco Decking, Inc.; a Nucor company.
 - 4. Vulcraft Group; Division of Nucor Corp.
 - 5. Vulcraft/Verco Group; a division of Nucor Corp.
- B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard baked-on, rust-inhibitive primer.
 - 2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), zinc coating.
 - 3. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - 4. Profile Depth: .
 - 5. Design Uncoated-Steel Thickness: .
 - 6. Span Condition: .

2.4 NONCOMPOSITE FORM DECK

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite deck panels used as a form to comply with SDI NC, with the minimum section properties indicated, and with the following:
 - 1. Uncoated Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 33 (230) minimum.
 - 2. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 33 (230) minimum, with underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 3. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating.
 - 4. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: Manufacturer's standard.
 - 5. Profile Depth: 2 inches (51 mm).
 - 6. Design Uncoated-Steel Thickness: 0.0474 inch (1.20 mm).
 - 7. Span Condition: Triple span or more.
 - 8. Side Laps: Interlocking seam.

2.5 ACCESSORIES

- A. 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. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile indicated recommended by SDI standards for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch (1.90 mm) thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Galvanizing Repair Paint: ASTM A780/A780M SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.
- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; 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 may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.

3.2 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members by #12 screws as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or as indicated, and as follows:
 - 1. Mechanically clinch or button punch.
 - 2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
 - 1. End Joints: Lapped 2 inches (50 mm) minimum .
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (300 mm) apart with at least one fastener at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

3.3 INSTALLATION OF FLOOR DECK

- 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: 5/8 inch (16 mm), nominal.

2. Weld Spacing:
 - a. Space and locate welds as indicated.
3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated not exceeding the lesser of one-half of the span or 36 inches (1 m) , and as follows:
 1. Mechanically clinch or button punch.
 2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm) **<Insert dimension>**, with end joints as follows:
 1. End Joints: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.4 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Painting:
 1. Wire brush and clean rust spots, welds, and abraded areas on top surface of prime-painted deck immediately after installation, and apply repair paint.
 2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
 - a. Field welds will be subject to inspection.
 2. Steel decking will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Miscellaneous framing and supports.
 - 2. Loose steel lintels.
 - 3. Steel weld plates and angles.
 - 4. Metal ladders.
 - 5. Metal bollards.
 - 6. Abrasive metal nosings, treads, and thresholds.
 - 7. Metal downspout boots.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
 - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
 - 3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- C. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 2. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Fasteners.
 - 2. Shrinkage-resisting grout.
 - 3. Manufactured metal ladders.
 - 4. Abrasive metal nosings, treads, and thresholds.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Research Reports: For post-installed anchors.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications 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 A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- E. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
- H. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum stainless steel or nickel silver.
 - 2. Provide bronze fasteners for fastening bronze.

- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ISO 898-1, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- F. Post-Installed Anchors: Torque-controlled expansion anchors.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593 (ISO 3506-1), and nuts, ASTM F594 (ASTM F836M).

2.3 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 that contains pigments that make it easily distinguishable from zinc-rich primer.
- B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- F. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use

connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Galvanize miscellaneous framing and supports where indicated.

2.6 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Galvanize loose steel lintels located in exterior walls.

2.7 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.8 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
 - 1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
 - 2. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
 - 3. Rungs: 3/4-inch- (19-mm-) round, steel bars.
 - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
 - 6. Nonslip Surfaces for Steel Ladders: Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) IKG.
 - 2) SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC.
 - 7. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
 - 8. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
 - 9. Primeladders, including brackets and fasteners, with zinc-rich primer.

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.
 - 1. Cap bollards not filled with concrete with 1/4-inch- (6.4-mm-) thick, steel plate with flat top.
- B. Fabricate bollards with 3/8-inch- (9.5-mm-) thick, steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch (19-mm) anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.
- D. Prime steel bollards with zinc-rich primer.

2.10 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Extruded Units: Aluminum, with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 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. American Safety Tread Co., Inc.
 - b. Balco; a CSW Industrials Company.
 - c. Wooster Products Inc.
 - 2. Source Limitations: Obtain units from single source from single manufacturer.
 - 3. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
 - 4. Nosings:
 - a. Interior Basis-of-Design: Wooster Supergrit Type 630A
 - 1) Color:
 - a) Top and Bottom treads and at landings: SY-1 Safety Yellow
 - b) Intermediate Treads: Black BLA-1
 - b. Exterior Basis-of-Design: Wooster Supergrit Type 241BF
 - 1) Color: Black BLA-1
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c., evenly spaced

between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

1. Provide two rows of holes for units more than 5 inches (125 mm) wide, with two holes aligned at ends and intermediate holes staggered.

- D. Apply clear lacquer to concealed surfaces of extruded units.

2.11 METAL DOWNSPOUT BOOTS

- 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. J.R. Hoe & Sons Inc.
2. Neenah Foundry Company.

- B. Source Limitations: Obtain downspout boots from single source from single manufacturer.

- C. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

1. Outlet: **[Vertical, to discharge into pipe] [Horizontal, to discharge into pipe] [At 35 degrees from horizontal, to discharge onto splash block or pavement].**

- D. Prime cast-iron downspout boots with **[zinc-rich primer.] [primer specified in Section 099600 "High-Performance Coatings."]**

2.12 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

- A. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- B. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. 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.
- C. Field Welding: Comply with the following requirements:
 - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.
- C. Anchor shelf angles securely to existing construction with anchor bolts.

3.3 INSTALLATION OF SHELF ANGLES

- A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 055113 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Preassembled steel stairs with concrete-filled treads.
 - 2. Steel tube railings and guards attached to metal stairs.
 - 3. Steel tube handrails attached to walls adjacent to metal stairs.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for stair nosings

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:
 - 1. Prefilled metal-pan-stair treads.
 - 2. Abrasive nosings.
 - 3. Shop primer products.
 - 4. Nonslip-aggregate concrete finish.
 - 5. Handrail wall brackets.
 - 6. Grout.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
 - 3. Include plan at each level.
 - 4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
- C. Delegated Design Submittal: For stairs railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. 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. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, railings, and guards including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs 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. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, 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. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.2 METALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) or ASTM A513/A513M.
- C. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

- D. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.

- E. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T6.

- F. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 ABRASIVE NOSINGS

- A. See Section 055000 "Metal Fabrications"

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 [Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5] where built into exterior walls.

1. Select fasteners for type, grade, and class required.

- B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.

- B. Shop Primers:

- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, and guards, 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. Assemble stairs, railings, and guards in shop to greatest extent possible.

1. Disassemble units only as necessary for shipping and handling limitations.

2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 2. 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 Finish #2 - Completely sanded joint with some undercutting and pinholes okay.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 2. Locate joints where least conspicuous.
 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 4. Provide weep holes where water may accumulate internally.

2.7 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Service Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 1. Stringers: Fabricate stringers of steel channels.
 - a. Stringer Size: As required to comply with "Performance Requirements" Article.
 - b. Provide closures for exposed ends of channel and rectangular tube stringers.
 - c. Finish: Shop primed.
 2. Platforms: Construct of steel channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 - b. Finish: Shop primed.
 3. Weld or bolt stringers to headers; weld or bolt 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 (1.7 mm).
 - 1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
 - 2. Steel Sheet: Uncoated, hot or cold-rolled steel sheet.
 - 3. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 - 4. Shape metal pans to include nosing integral with riser.
 - 5. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
 - 6. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.8 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

2.9 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 - 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. 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.
 - 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.
 - b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- 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.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 2. 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.
 - 3. Comply with requirements for welding in "Fabrication, General" Article.
- F. 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.
 - 2. Center nosings on tread width.
 - 3. **Seal Concrete**

3.3 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
 - 1. Space posts at spacing indicated or, if not indicated, as required by design loads.
 - 2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
 - 4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by welding or bolting to steel supporting members.
 - b. Anchor handrail and guards ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

- B. Attach handrails to wall with wall brackets.
 - 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 2. Secure wall brackets to building construction as required to comply with performance requirements.

3.4 REPAIR

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055113

SECTION 055119 - METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal grating stairs.
- B. Related Requirements:
 - 1. Section 955213 "Pipe and Tube Railings" for railings and guards.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs, railings, and guards.
 - 1. 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.
 - 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
 - 1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For metal grating stairs and the following:
 - 1. Gratings.
 - 2. Shop primer products.
 - 3. Grout.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachment to other work.
 - 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
 - 3. Include plan at each level.
 - 4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
- C. Delegated Design Submittal: For stairs, railings, and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect steel members and packaged materials from corrosion and deterioration.
 - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, railings, and guards, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs 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. (4.79 kN/sq. m).
 - 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, 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. (0.73 kN/m) applied in any direction.

- b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

- D. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.2 METALS

- A. Metal Surfaces: 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 A36/A36M.
- C. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.
- D. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.
- E. Provide galvanized finish for exterior installations and where indicated.

2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
 - 1. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for exterior stairs.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. 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.
- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with ASTM A780/A780M and compatible with paints specified to be used over it.
- E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, 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. Assemble stairs, railings, and guards in shop to greatest extent possible.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 - 2. 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 Finish # 3 - Partially dressed weld with spatter removed.

- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 - 2. Locate joints where least conspicuous.
 - 3. Fabricate joints that are exposed to weather in a manner to exclude water.
 - 4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers of steel channels.
 - a. Stringer Size: As required to comply with "Performance Requirements" Article.
 - b. Provide closures for exposed ends of channel stringers.
 - c. Finish: Galvanized.
 - 2. Construct platforms and tread supports of steel channel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
 - a. Provide closures for exposed ends of channel framing.
 - b. Finish: Galvanized.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
- C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."
 - 1. Fabricate treads and platforms from welded steel or pressure-locked steel grating with openings in gratings no more than 1/2 inch (12 mm) in least dimension.
 - a. Surface: Serrated.
 - b. Finish: Mill.
- D. Risers: Open.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 2. 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.

- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. 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.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 - 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. 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.
 - 1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.
 - a. Clean bottom surface of baseplates.
 - b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
 - c. After stairs have been positioned and aligned, tighten anchor bolts.
 - d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- 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.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. 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.
3. Comply with requirements for welding in "Fabrication, General" Article.

3.3 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
 1. Space posts at spacing indicated or, if not indicated, as required by design loads.
 2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
 4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by welding to steel supporting members.
 - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.
- B. Attach handrails to wall with wall brackets.
 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 2. Secure wall brackets to building construction as required to comply with performance requirements.

3.4 REPAIR

- A. Touchup Painting:
 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055119

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel railings.

1.2 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.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Fasteners.
 - 3. Post-installed anchors.
 - 4. Handrail brackets.
 - 5. Shop primer.
 - 6. Intermediate coats and topcoats.
 - 7. Nonshrink, nonmetallic grout.
 - 8. Anchoring cement.
 - 9. Metal finishes.
 - 10. Paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated design professional engineer.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

- D. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- E. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, 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. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 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.
 - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

- A. Pipe: ASTM A53/A53M, 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.

- B. Plates, Shapes, and Bars: ASTM A36/A36M.

2.4 FASTENERS

- A. Fastener Materials:
 - 1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
 - 2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
 - 3. Finish exposed fasteners to match appearance, including color and texture, of railings.
- 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 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.
 - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: 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.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast iron center of handrail 2-1/2 inches (63.5 mm) from face of railing and wall.

- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. 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.
- F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- H. Intermediate Coats and Topcoats: Provide products that comply with [Section 099113 "Exterior Painting."] [Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]
- I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- K. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- L. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.6 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.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 - 2. 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.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. As detailed.
- K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- M. 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 (6 mm) or less.
- N. 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.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.

2. Coordinate anchorage devices with supporting structure.

- P. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

- A. Galvanized Railings:
1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 3. Comply with ASTM A153/A153M 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 and as follows.
1. Comply with SSPC-SP 16.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
1. Exterior Railings: SSPC-SP 6/NACE No. 3.
 2. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
 3. Railings Indicated To Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3.
 4. Other Railings: SSPC-SP 3.
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Shop prime uncoated railings with universal shop primer unless zinc-rich primer is indicated.
 2. Do not apply primer to galvanized surfaces.
- G. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Architect from manufacturer's full range.

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. Perform cutting, drilling, and fitting required for installing railings.
 1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. 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.
 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 6. 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 (6 mm in 3.5 m).
- B. 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 concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. 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. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. 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.
- C. 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 (50 mm) beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post [anchoring material flush with adjacent surface].
- C. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach handrails to walls with wall brackets, except where end flanges are used. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. 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.
 - 2. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements, using self-tapping screws of size and type required to support structural loads.
- E. Install railing gates level, plumb, and secure for full opening without interference.
 - 1. Attach hardware using tamper-resistant or concealed means.
 - 2. Adjust hardware for smooth operation.

3.6 REPAIR

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [**Section 099113 "Exterior Painting."**] [**Section 099123 "Interior Painting."**] [**Section 099600 "High-Performance Coatings."**]

3.7 CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

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.
- B. 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.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Framing with engineered wood products.
 - 3. Shear wall panels.
 - 4. Rooftop equipment bases and support curbs.
 - 5. Wood blocking and nailers.
 - 6. Wood furring.
 - 7. Wood sleepers.
 - 8. Plywood backing panels.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of process and factory-fabricated product.
 - 2. For preservative-treated wood products.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates:
 - 1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
 - 2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Engineered wood products.
 - 4. Shear panels.
 - 5. Power-driven fasteners.
 - 6. Post-installed anchors.
 - 7. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece .
 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
1. Boards: 19 percent.
 2. Dimension Lumber: 19 percent unless otherwise indicated.
 3. Timber: 19 percent.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable design stresses, as published by manufacturer, are to meet or exceed those indicated. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATMENT

- A. General: Where fire-retardant-treated materials are indicated, materials are to comply 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.

- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Framing for raised platforms.
 - 2. Framing for stages.
 - 3. Concealed blocking.
 - 4. Framing for non-load-bearing partitions.
 - 5. Framing for non-load-bearing exterior walls.
 - 6. Roof construction.
 - 7. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions by Grade: Construction or No. 2 grade.
 - 1. Application: Interior partitions not indicated as load bearing.
 - 2. Species:
 - a. Douglas fir-larch; WCLIB or WWP.
- B. Framing Other Than Non-Load-Bearing Partitions by Grade: No. 2 grade.
 - 1. Application: Framing other than interior partitions not indicated as load bearing.
 - 2. Species:
 - a. Douglas fir-larch; WCLIB or WWP.
- C. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - 1. Species and Grade: As indicated above for load-bearing construction of same type.

2.5 ENGINEERED WOOD PRODUCTS

- A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Boise Cascade.
 - b. Louisiana-Pacific Corporation.
 - c. Pacific Woodtech Corporation.
 - d. RedBuilt.
 - e. Roseburg.
 - f. West Fraser.
 - g. Weyerhaeuser Company.
 2. Extreme Fiber Stress in Bending, Edgewise: as indicated. for 12-inch nominal- (286-mm actual-) depth members.
 3. Modulus of Elasticity, Edgewise: as indicated..
- B. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D5055.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Boise Cascade.
 - b. Louisiana-Pacific Corporation.
 - c. Nascor Systems.
 - d. Pacific Woodtech Corporation.
 - e. RedBuilt.
 - f. Roseburg.
 - g. Stark Truss Company, Inc.
 - h. Weyerhaeuser Company.
 2. Web Material: Either OSB or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1 .
 3. Structural Properties: Depths and design values not less than those indicated.
 4. Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA-EWS standard.
- C. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.
1. Manufacturer: Provide products by same manufacturer as I-joists.
 2. Material: All-veneer product or product made from any combination solid lumber, wood strands, and veneers.
 3. Thickness: 1-1/4 inches (32 mm).
 4. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.
- D. Insulated Rim Boards: Insulated product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research/evaluation report for I-joists.
1. Manufacturer: Provide products by same manufacturer as I-joists.
 2. Rim Board Material: All-veneer product or product made from any combination solid lumber, wood strands, and veneers.
 3. Rim Board Thickness: 1-1/4 inches (32 mm).

4. Insulation: 1-1/2-inch- (38-mm-) thick polyisocyanurate foam complying with ASTM C1289.
5. Inside Facing: 7/16-inch- (11-mm-) thick OSB.
6. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

2.6 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Rooftop equipment bases and support curbs.
 4. Cants.
 5. Furring.
 6. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
 1. Northern species; No. 2 Common grade; NLGA.
 2. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

2.7 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.8 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. MiTek Industries, Inc.
 2. Simpson Strong Tie.
- B. Allowable design loads, as published by manufacturer, are to meet or exceed those of basis-of-design products of products of manufacturers listed. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and

demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.

- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 - 1. Use for wood-preservative-treated lumber and where indicated.

2.9 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets:
 - 1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
 - 2. Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
 - 3. Self-adhering sheet consisting of 64mils (1.6 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) 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.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

- D. Install shear wall panels to comply with manufacturer's written instructions.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Parapet sheathing.
 - 4. Composite nail base insulated roof sheathing.
 - 5. Subflooring.
 - 6. Underlayment.
 - 7. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated plywood.
 - 2. Fire-retardant-treated plywood.
 - 3. Foam-plastic sheathing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; 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 WOOD PANEL PRODUCTS

- A. Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. 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.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber plywood is to be tested in accordance with ASTM D5516 and design value adjustment factors are to be calculated in accordance with ASTM D6305. Span ratings after treatment are to be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings.

2.5 WALL SHEATHING

- A. Plywood Sheathing, Walls: Either DOC PS 1 or DOC PS 2, Exterior sheathing or as indicated.

2.6 ROOF SHEATHING

- A. Plywood Sheathing, Roofs: Either DOC PS 1 or DOC PS 2, Exterior sheathing or as indicated.

2.7 SUBFLOORING AND UNDERLAYMENT

- A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Structural I, Underlayment single-floor panels.

- B. Oriented-Strand-Board Combination Subfloor-Underlayment: DOC PS 2, Exposure 1 single-floor panels.
- C. Plywood Subflooring: Either DOC PS 1 or DOC PS 2, Exterior, Structural I single-floor panels or sheathing.
- D. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.
 - 1. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch (15.9-mm) nominal thickness.
 - 2. Plywood Underlayment for Carpet: DOC PS 1, Exposure 1, Underlayment Interior, Underlayment.

2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
 - 2. For roof parapet and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117.

2.9 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.10 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

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 2304.10.1, "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 parapet and roof 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.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
1. Combination Subfloor-Underlayment:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch (3 mm) apart at edges and ends.
 2. Subflooring:
 - a. Glue and nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch (3 mm) apart at edges and ends.
 3. Wall and Roof Sheathing:
 - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch (3 mm) apart at edges and ends.
 4. Underlayment:
 - a. Nail to subflooring.
 - b. Space panels 1/32 inch (0.8 mm) apart at edges and ends.
 - c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to wood framing with nails or screws.
 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 3. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
 4. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

3.4 CEMENTITIOUS BACKER UNIT INSTALLATION

- A. Install panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 FOAM-PLASTIC SHEATHING INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
- C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.6 PARTICLEBOARD UNDERLAYMENT INSTALLATION

- A. Comply with CPA's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.
 - 1. Fastening Method: Glue and nail underlayment to subflooring.

3.7 HARDBOARD UNDERLAYMENT INSTALLATION

- A. Comply with CPA's recommendations and hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.
 - 1. Fastening Method: Nail underlayment to subflooring.

END OF SECTION 061600

SECTION 061715 - ENGINEERED STRUCTURAL WOOD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural composite lumber.
 - 2. Prefabricated wood I-joists.
 - 3. Engineered rim boards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication and installation details for engineered wood members.
 - 1. Include alternate span loading design results in design calculations.
 - 2. Provide documentation that allowable design stresses comply with allowable design properties of each product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Research reports.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in ASTM D5055 or ASTM D5456, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction .

PART 2 - PRODUCTS

2.1 STRUCTURAL COMPOSITE LUMBER

- A. General: Provide structural composite lumber that complies with ASTM D5456 and ASTM D2559 or research/evaluation reports acceptable to authorities having jurisdiction.
- B. Laminated-Veneer Lumber (LVL): Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored in accordance with ASTM D5456, and manufactured with exterior-type adhesive complying with ASTM D2559.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Boise Cascade.
 - b. Louisiana-Pacific Corporation.
 - c. Pacific Woodtech Corporation.
 - d. RedBuilt.

- e. Roseburg.
 - f. West Fraser.
 - g. Weyerhaeuser Company.
 - 2. Allowable Stresses:
 - a. Extreme Fiber Stress in Bending, Edgewise (Fb): as indicated for 12-inch nominal- (286-mm actual-) depth members.
 - b. Modulus of Elasticity, Edgewise (E): as indicated.
 - 3. Moisture Protection: Factory seal edge and ends with manufacturer's standard water-resistant coating.
- C. Laminated-Strand Lumber (LSL): Structural composite lumber made from wood flake strands with grain primarily parallel to member lengths, evaluated and monitored in accordance with ASTM D5456, and manufactured with exterior-type adhesive complying with ASTM D2559.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Tolko Industries, LTD.
 - b. Weyerhaeuser Company.
 - 2. Allowable Stresses:
 - a. Extreme Fiber Stress in Bending, Edgewise (Fb): as indicated for 12-inch nominal- (286-mm actual-) depth members.
 - b. Modulus of Elasticity, Edgewise (E): as indicated..
 - 3. Moisture Protection: Factory seal face, edge and ends with manufacturer's standard water-resistant coating.

2.2 PREFABRICATED WOOD I-JOISTS

- A. Prefabricated Units: I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural webs, let into and bonded to flanges. Comply with material requirements of, and with structural capacities established and monitored in accordance with, ASTM D5055.
- 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. Boise Cascade.
 - b. Louisiana-Pacific Corporation.
 - c. Nascor Systems.
 - d. Pacific Woodtech Corporation.
 - e. RedBuilt.
 - f. Roseburg.
 - g. Stark Truss Company, Inc.
 - h. Weyerhaeuser Company.
 - 2. Flange Material: Laminated-veneer or machine stress-rated (MSR) lumber.
 - 3. Web Material: OSB, Exposure 1.
 - 4. Structural Properties: Depths and design values not less than those indicated.
 - 5. Identification Marks:
 - a. Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist series, referenced standard (APA PRI-400) or APA Product Report number, and manufacturing plant number.
 - b. Factory mark I-joists with manufacturer's name, joist series, mill identification, manufacturing date and time, name of third-party inspection

agency, and ICC/CCMC code report number. Repeat identification marks at minimum 12 ft. (3.66 m) intervals.

2.3 ENGINEERED RIM BOARDS

- A. Prefabricated, structural panel complying with APA PRR 410, APA PRR 401, or ASTM D7672 for wood frame construction and research or evaluation report for I-joists.
 - 1. Manufacturer: Provide products by same manufacturer as I-joists.
 - 2. Material: OSB or LVL.
 - 3. Thickness: 1-1/4 inches (32 mm).
 - 4. Identification Marks: Comply with APA PRR-401, rim board rim board plus grade.
 - a. Factory mark rim board with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.
 - b. Factory mark rim boards with manufacturer's name, rim board series, mill identification, manufacturing date and time, name of third-party inspection agency, and ICC/CCMC code report number. Repeat identification marks at minimum 12 ft. (3.66 m) intervals.

2.4 FASTENERS

- A. General: Fasteners are to be of size and type indicated and to comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
 - 2. For pressure-preservative-treated wood, use stainless steel fasteners.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.
- E. Carbon Steel Bolts: ASTM A307 with ASTM A563 (ASTM A563M) hex nuts and, where indicated, flat washers all hot-dip zinc coated.
- F. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2; with ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4) hex nuts and, where indicated, flat washers.
- G. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.5 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. MiTek Industries, Inc.
 2. Simpson Strong Tie.
 3. Tamlyn.
- B. Allowable design loads, as published by manufacturer, are to meet or exceed those of basis-of-design products of products of manufacturers listed. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.
- C. I-joist Hangers: U-shaped joist hangers with seat and nailing flanges, full depth of joist, as indicated on Drawings. Nailing flanges provide lateral support at joist top chord.
1. Thickness: as indicated .
 2. Finish: Galvanized .
- D. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
1. Strap Width: 2 inches (50 mm).
 2. Thickness: as indicated .
- E. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.
- F. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.
- G. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
1. Width: 3/4 inch (19 mm).
 2. Thickness: 0.050 inch (1.3 mm).
 3. Length: As indicated.
 4. Or: as indicated.
- H. Materials: Unless otherwise indicated, fabricate from the following materials:
1. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.
 - a. Use for interior locations unless otherwise indicated.
 2. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 3. Stainless steel bars and shapes complying with ASTM A276/A276M, Type 316.
 - a. Use for exterior locations and where indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets:

1. Glass-fiber-resilient insulation, fabricated in strip form, for use as sill sealer; 1-inch (25-mm) nominal thickness, compressible to 1/32 inch (0.8 mm); selected from manufacturer's standard widths to suit width of sill members indicated.
2. Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to suit width of sill members indicated.
3. Self-adhering sheet consisting of 64 mils (1.6 mm) of rubberized asphalt laminated on one side to 4-mil- (0.10-mm-) 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.

PART 3 - EXECUTION

3.1 INSTALLATION OF STRUCTURAL COMPOSITE LUMBER

- A. Install to comply with ESR report, manufacturer's written instructions, and applicable code.
 1. Install in dry, covered conditions where average in-service moisture content of lumber is 16 percent or less.
 2. Install metal framing connections in accordance with AWC's "National Design Specification (NDS) for Wood Construction." Install fasteners through each fastener hole.
 3. Install lumber plumb and level. Accurately fit, align, securely fasten, and install free from distortion or defects.
 4. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
- B. Cutting: Confirm size and location of field cutting, notching, and drilling with ESR report, registered design professional, and manufacturer.

3.2 INSTALLATION OF PREFABRICATED WOOD I-JOISTS

- A. Install to comply with ESR report, manufacturer's written instructions, and applicable code.
 1. Install in dry, covered conditions where in-service moisture content of wood does not exceed 16 percent.
 2. Install metal framing connections in accordance with AWC's "National Design Specification (NDS) for Wood Construction." Install fasteners through each fastener hole.
 3. Install joists with top and bottom flanges within 1/2 inch (12.7 mm) of true vertical alignment, and support ends of each member with not less than 1-3/4 inches (44.5 mm) for end bearing and 3-1/2 inches (76 mm) for intermediate bearings.
 4. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 5. Provide lateral restraint at supports to prevent rotation, and along the compression flange of each joist.
- B. Cutting: Do not splice structural members between supports unless otherwise indicated.

- C. Engineered Rim Boards: Install at bearing walls perpendicular to and supported by I-joists that require full-depth blocking, or rim joists, at supports.
- D. Sill Sealer Gasket: Install to form continuous seal between sill plates and foundation walls.

3.3 INSTALLATION OF ENGINEERED RIM BOARDS

- A. Install at bearing walls perpendicular to and supported by I-joists that require full-depth blocking, or rim joists, at supports.
- B. Sill Sealer Gasket: Install to form continuous seal between sill plates and foundation walls.

END OF SECTION 061715

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood roof trusses.
 - 2. Wood floor trusses.
 - 3. Wood girder trusses.

1.2 ALLOWANCES

- A. Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Section 012100 "Allowances."

1.3 ACTION SUBMITTALS

- A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
- B. Shop Drawings: Show fabrication and installation details for trusses.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of lumber.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 6. Show splice details and bearing details.
- C. Delegated-Design Submittals: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Metal-plate connectors.
 - 2. Metal truss accessories.

1.5 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that .

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses are to be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpine, a division of ITW Inc.
 - 2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
 - 3. Eagle Metal Products.
 - 4. MiTek Industries, Inc.
- B. Fabricate connector plates to comply with TPI 1.
- C. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 (Z180) coating designation; and not less than 0.036 inch (0.9 mm) thick.

2.4 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 - 2. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. MiTek Industries, Inc.
 - 2. Simpson Strong Tie.
- B. Allowable design loads, as published by manufacturer, are to comply with or exceed those of basis-of-design products of products of manufacturers listed. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

2.6 FABRICATION

- A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

- B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- F. Securely connect each truss ply required for forming built-up girder trusses.
- G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061000 "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- H. Install wood trusses within installation tolerances in TPI 1.
- I. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- J. Replace wood trusses that are damaged or do not comply with requirements.

END OF SECTION 061753

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-clad architectural cabinets.
 - 2. Cabinet hardware and accessories.
 - 3. Miscellaneous materials.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
 - 2. Section 087100 "Door Hardware" for keying cabinetry locks.
 - 3. Section 123661.16 "Solid Surface Countertops."

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Plastic-laminate-clad architectural cabinets.
 - 2. Cabinet hardware and accessories.
 - 3. Miscellaneous materials.
- B. Product Data Submittals: For each product.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show large-scale details.
 - 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
 - 5. Apply AWI Quality Certification or WI Certified Compliance Program label to Shop Drawings.
- D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.

- B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum 10 years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

1.5 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: [AWI Quality Certification Program] [WI Certified Compliance Program] certificates.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: 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.
 - 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program or WI's Certified Compliance Program.
- B. Installer Qualifications: Manufacturer of products.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are 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 cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINETS

- A. Single-Source Responsibility: Provide and install this work from single fabricator.

2.2 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide labels and certificates from AWI or WI certification program indicating that woodwork complies with requirements of grades specified.
- B. Architectural Woodwork Standards Grade: Custom.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.
- E. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.
 - 1. Manufacturers:
 - a. Formica Corporation: www.formica.com/#sle.
 - b. Nevamar: www.nevamar.com
 - c. Panalom Industries International, Inc; Nevamar: www.nevamar.com.
 - d. Wilsonart: www.wilsonart.com.
 - e. Other Manufacturers specifically noted in Drawings and Material Schedule.
 - f. Substitutions: Refer to Section 016310 – Substitutions.
- F. Exposed Surfaces:
 - 1. Plastic-Laminate Grade: VGS.
 - 2. Edges: Grade VGS
 - 3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
- G. Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, ISO 4586-3
 - a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish [
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.
 - 2. Drawer Sides and Backs: Solid-hardwood lumber
 - 3. Drawer Bottoms: Hardwood plywood
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.
- I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. As indicated on drawings.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 1. Wood Moisture Content: 4 to 9 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 1. Softwood Plywood: DOC PS 1.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets.
 1. Manufacturer:
 - a. Builders Brass.
 - b. Amerock (National).
 - c. Quality.
 2. Substitutions: Refer to Section 016310 – Substitutions.
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening, self-closing.
- C. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.
- D. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.
- E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04102; with shelf brackets, B04112.
- F. Drawer Slides: ANSI/BHMA A156.9.
 1. Standard Duty (Grade 1 and Grade 2): Side mount for drawers 24" wide or less. Accuride 7432 ball bearing, rail mount, full extension slides with 100 lb./pr. load rating.
 2. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount for drawers 42" wide or less. Accuride 3640A ball bearing, rail mount, full extension slides plus one inch (25mm) overtravel with 200 lb./pr. load rating.
 - a. Type: Full extension.
 - b. Material: Galvanized steel ball bearing slides.
 - c. Motion Feature: Self-closing mechanism.

- G. Door Locks: ANSI/BHMA A156.11
 - 1. Medeco M³ SFIC cabinet lock with deadbolt
- H. Drawer Locks: ANSI/BHMA A156.11
 - 1. Medeco M³ SFIC cabinet lock with deadbolt
- I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 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 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 and at floors.
- C. Adhesive for Bonding Plastic Laminate: Type I, waterproof type as selected by fabricator to comply with requirements.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. 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.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

- B. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- C. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings 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.
 - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

3.4 KEYING

- A. Refer to Section 087100 “Door Hardware”

END OF SECTION 064116

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic sheet paneling.
 - 2. Plastic wall liner panels
 - 3. Plastic ceiling panels

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight 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 SOURCE LIMITATIONS

- A. Obtain plastic sheet paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING (FRP)

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319. Panels are to be USDA accepted for incidental food contact.
 - 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. Crane Composites, Inc.
 - b. Glasteel.
 - c. Marlite, Inc.
 - 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 200 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 3. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
 - 4. Surface Finish: Smooth texture.
 - 5. Color: White.

B. ACCESSORIES

1. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - a. Color: Match panels.
2. Adhesive: As recommended by plastic paneling manufacturer.

2.3 PLASTIC WALL AND CEILING LINER PANELS

A. Manufacturers

1. Basis of Design Manufacturer: Trusscore Inc.

B. Performance Requirements

1. Physical Performance:
 - a. Impact Resistance: Minimum 2.08 In-l/mil in according to ASTM D4226.
 - b. Coefficient of Thermal Expansion: Maximum 5.7×10^{-5} in/in/°F; according to ASTM D696.
 - c. Material Density: Density rating of 1.46 according to ASTM D792.
 - d. Tensile Strength: Minimum of 6575 psi rating according to ASTM D638.
2. Surface-Burning Characteristics: Meet the following values according to ASTM E84 and CAN/ULC-S102:
 - a. ASTM E84 Class A Flame-Spread Index: 15.
 - b. ASTM E84 Smoke Developed Index: 450.
3. Environmental Performance:
 - a. Food Processing Facilities: CFIA approved and compliant with FDA and USDA guidelines.
 - b. Fungus Resistance: Pass; Growth rating of 0 according to ASTM G21 and ISO 846:2019. Boards do not contain cellulosic material.
4. Waterproof; nonporous.
5. Corrosion Proof:

C. Basis-of-Design Product: Trusscore Wall&CeilingBoard, by Trusscore Inc.

1. General: Provide Tongue-and-groove, Rib-reinforced PVC liner panel with nailing fins.
2. Description:
 - a. Material: PVC;
 - b. Outside Surface: Flat.
 - c. Width: 16-Inches (406-mm).
 - d. Length: 20-Feet.
 - e. Thickness: 1/2-Inch (13-mm).
 - f. Weight: 0.8 Pounds per square foot.
 - g. Color: White

D. Accessories

1. Basis-of-Design Product: Trusscore PVC Trim, by Trusscore Inc.
 - a. Base Trim.

- b. F Trim.
- c. H Channel Snap-In Kit.
- d. Inside Cove Corner.
- e. J Trim 1/2 inch.
- f. Outside Corner.
- g. 45 Degree H Channel.
- 2. Material: PVC;
- 3. Color: White

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, 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 substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- D. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches (300 mm) wide.
 - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 - 2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive. Do not fasten through panels.
- D. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- E. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool blanket insulation.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for insulation installed in masonry cells.
2. Section 075419 "Polyvinyl-Chloride (PVC) Roofing" for insulation specified as part of roofing construction.
3. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.
4. Mineral-wool blanket insulation.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Research Reports: For foam-plastic insulation, from ICC-ES.

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 until just before installation time.
 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 APPLICATIONS

- A. Extruded polystyrene foam-plastic board insulation:
 - 1. Insulation under concrete slabs
 - 2. Insulation at perimeter of foundation
- B. Polyisocyanurate foam-plastic board insulation:
 - 1. Insulation on inside of concrete or masonry walls
 - a. Foil-Faced
- C. Glass-fiber blanket insulation:
 - 1. Insulation in roof joist space.
 - a. Exposed: Unfaced with black polypropylene scrim
 - b. Concealed: Unfaced
 - 2. Insulation in exterior metal framing walls (PEMB)
 - a. Unfaced
- D. Mineral-wool blanket insulation.
 - 1. Exposed insulation in PEMB
 - a. See drawings

2.2 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.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.
- C. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
- D. Thermal-Resistance Value (R-Value): R-value as indicated on Drawings in accordance with ASTM C518.

2.3 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type VII below grade slab and wall insulation: ASTM C578, Type VII, 60-psi (414-kPa) minimum compressive strength.
 - 1. Manufacturers: Subject to compliance with
 - a. Owens Corning
 - b. John Mansville

2.4 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Foil Faced insulation on inside of concrete or masonry exterior walls: ASTM C1289, foil faced, Type I, Class 1 or 2.
 - 1. Manufacturers: Subject to compliance with performance requirements
 - a. Owens Corning
 - b. John Mansville
 - c. Or equal

2.5 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced Batt insulation ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with
 - a. Owens Corning
 - b. John Mansville
- B. Glass-Fiber Blanket Insulation, Reinforced-Foil Faced FSK Batt insulation ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
 - 1. Manufacturers: Subject to compliance with
 - a. Owens Corning
 - b. John Mansville

2.6 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced Mineral Wool Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with
 - a. Rockwool
 - b. Thermafiber
 - c. Knauf

2.7 INSULATION FASTENERS

- A. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
 - 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
 - d. Where exposed.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.8 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- 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. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.

- B. Anchor Installation: Install board insulation on concrete or masonry substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete or masonry substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 - 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 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.
 - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. 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 (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward interior of construction.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 INSTALLATION OF REFLECTIVE INSULATION

- A. Install sheet reflective insulation in accordance with ASTM C727.
- B. Install sheet radiant barriers in accordance with ASTM C1744.
- C. Install interior radiation control coating system in accordance with ASTM C1321.

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

- B. 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 072100

SECTION 074116 - INSULATED METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Foamed-insulation-core metal roof panels.
- B. Related Requirements:
 - 1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.
 - 2. Section 076200 "Sheet Metal Flashing and Trim"
 - 3. Section 077200 "Roof Accessories" for gutters and downspouts
 - 4. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
 - 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 structural loading limitations of purlins and rafters during and after roofing.
 - 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
 - 7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 8. Review temporary protection requirements for metal panel systems during and after installation.
 - 9. Review of procedures for repair of metal panels damaged after installation.
 - 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. Product Data: For foamed-insulation-core metal roof panels. 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; 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 (1:10).
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For foamed-insulation-core metal roof panels, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels 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.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical roof area and eave, including fascia, and soffit as shown on Drawings; approximately 12 feet (3.5 m) square by full thickness, including attachments, underlayment, and accessories.
 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. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, 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 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 to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel 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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E72:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. 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. (0.3 L/s per sq. m) when tested according to ASTM E1680 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- E. 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 FOAMED-INSULATION-CORE METAL ROOF PANELS

- A. Provide factory-formed and -assembled metal roof panels fabricated from two sheets of metal with insulation core foamed in place during fabrication with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - 1. Panel Performance:
 - a. Flatwise Tensile Strength: 30 psi (200 kPa) when tested according to ASTM C297/C297M.
 - b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for seven days at 140 deg F (60 deg C) and 100 percent relative humidity according to ASTM D2126.
 - c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at 200 deg F (93 deg C) according to ASTM D2126.
 - d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at minus 20 deg F (29 deg C) according to ASTM D2126.
 - e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. (958-kPa) positive and negative wind load and with deflection of L/180 for 2 million cycles.

- f. Autoclave: No delamination when exposed to 2-psi (13.8-kPa) pressure at a temperature of 212 deg F (100 deg C) for 2-1/2 hours.
 - g. Fire-Test-Response Characteristics: Class A according to ASTM E108.
 2. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
 - b. Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested according to ASTM D1622.
 - c. Compressive Strength: Minimum 20 psi (140 kPa) when tested according to ASTM D1621.
 - d. Shear Strength: 26 psi (179 kPa) when tested according to ASTM C273.
- B. Standing-Seam-Profile, Foamed-Insulation-Core Metal Roof Panels: Formed with vertical tongue-and-groove ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by interlocking tongue-and-groove panel edges and mechanically attaching panels to supports using concealed clips located between panels and engaging edges of adjacent panels, and mechanically seaming panels together.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide the following or comparable product:
 - a. Metl-Span (a Nucor company): CFR Insulated Metal Roof Panel.
 2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Exterior Face Sheet: 24 gauge coated thickness with stucco embossed surface.
 - 1) Finish: Two-coat fluoropolymer.
 - 2) Color: Tahoe Blue
 - b. Interior Face Sheet: 26 gauge coated thickness with stucco embossed surface.
 - 1) Finish: Siliconized polyester.
 - 2) Color: Igloo White
 3. Joint Type: As standard with manufacturer.
 4. Panel Coverage: 42 inches (1067 mm).
 5. Panel Thickness:
 - a. Building A: 2.5 inches (64 mm).
 - b. Building B: 4 inches
 6. Thermal-Resistance Value (R-Value):
 - a. Building A: 21.9 according to ASTM C1363.
 - b. Building B: 35.0 according to ASTM C1363.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation

unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

- 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 ridges, 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- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Panel Fasteners: 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 EPDM or PVC sealing washers for exposed fasteners.
- D. Panel Sealants: Provide sealant types 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 (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C920; 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. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels 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. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal 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 Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. 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 panel manufacturer for application but not less than thickness of metal being secured.

2.5 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 unacceptable. 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. Exterior Facings and Accessories:
 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
- D. Interior Facings:
 1. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

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 primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
- 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 C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF FOAMED-INSULATION-CORE METAL ROOF PANELS

- 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. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal roof panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
 2. Shim or otherwise plumb substrates receiving metal panels.
 3. 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.
 4. Install screw fasteners in predrilled holes.
 5. Locate and space fastenings in uniform vertical and horizontal alignment.
 6. Install flashing and trim as metal panel work proceeds.
 7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 8. 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.
 9. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

- E. Standing-Seam, Foamed-Insulation-Core Metal Roof Panels: Fasten insulated metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
 - 1. Install clips to supports with self-tapping fasteners.
 - 2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so cleat, insulated metal roof panel, and factory-applied side-lap sealant are completely engaged.
- 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 roof panel manufacturers; or, if not indicated, provide types recommended in writing by metal roof panel manufacturer.
- G. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal panel installation, including accessories. Report results in writing.
- B. Remove and replace applications where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.6 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. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074116

SECTION 074213.19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Foamed-insulation-core metal wall panels.
- B. Related Requirements:
 - 1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 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 governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Foamed-insulation-core metal wall panels.
- B. Product Data Submittals: For each product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- C. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; 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 (1:10).

- D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels 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.
- B. 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 mockup of typical metal panel assembly, including corner, soffits, supports, attachments, and accessories.
 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 components, metal panels, 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 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.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 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 in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E72:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. 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. (0.3 L/s per sq. m) when tested in accordance with ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

- 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - 1. Radiant Heat Exposure: No ignition when tested in accordance with NFPA 268.
 - 2. Potential Heat: Acceptable level when tested in accordance with NFPA 259.
 - 3. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

2.2 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 - 1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested in accordance with ASTM D6226.
 - b. Density: 2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m) when tested in accordance with ASTM D1622.
 - c. Compressive Strength: Minimum 20 psi (140 kPa) when tested in accordance with ASTM D1621.
 - d. Shear Strength: 26 psi (179 kPa) when tested in accordance with ASTM C273/C273M.
- B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
 - 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide the following or comparable product:
 - a. Metl-Span (a Nucor company): CF Mesa Insulated Metal Wall Panel.
 - 2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

- a. Exterior Face Sheet: 24 gauge coated thickness with stucco embossed surface.
 - 1) Finish: Two-coat fluoropolymer.
 - 2) Color: Brownstone
- b. Interior Face Sheet: 26 gauge coated thickness with stucco embossed surface, Mesa profile.
 - 1) Finish: Siliconized polyester.
 - 2) Color: Igloo White
3. Panel Coverage: 36 inches nominal.
4. Panel Thickness: 2.0 inches (51 mm).
5. Thermal-Resistance Value (R-Value): 17.5 in accordance with ASTM C1363.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- 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- (25-mm-) 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: 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 EPDM or PVC sealing washers for exposed fasteners.
- E. 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 (13 mm) wide and 1/8 inch (3 mm) thick.

2. Joint Sealant: ASTM C920; 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. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels 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. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Honeycomb-Core Metal Wall Panels: Fabricate panels using manufacturer's standard thermosetting structural adhesive in a lamination process that bonds panel under minimum 10-psi (69-kPa) pressure. Use of contact adhesives with pinch-roll process is unacceptable.
 1. Panel Bow Tolerance: Not more than 0.5 percent of panel width or length.
- E. Sheet Metal 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 Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. 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.

2.5 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. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. 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 (0.013 mm).

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 in accordance with ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF METAL PANELS

- A. General: Install metal panels in accordance with 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. 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.
 - 8. 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.
 - 2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or 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. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.
 - 1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION OF INSULATION-CORE METAL WALL PANELS

- A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
 - 1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
 - 2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
 4. 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.
 5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
 6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
 7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.
- B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
1. Install clips to supports with self-tapping fasteners.
- C. 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 panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- D. 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. 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 (3 m) with no joints allowed within 24 inches (610 mm) 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- D. Metal wall panels will be considered defective if they do not pass test and inspections.

- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 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 074213.19

SECTION 074293 - SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal soffit panels.
- B. Related Requirements:

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Metal soffit panels.
- B. Product Data Submittals:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- C. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels 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.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
- C. 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 mockup of typical roof eave, including fascia,] and soffit as shown on Drawings; approximately four panels wide by full eave width, including attachments and accessories.
 - 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 components, metal panels, 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 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.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 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 Delta E 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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel 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. Other Design Loads: As indicated on Drawings.
 - 3. 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. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL SOFFIT PANELS

- A. 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. **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. MBCI
 - b. PAC-Clad
 - c. [Englert, Inc.](#)
 - d. [Metal Sales Manufacturing Corporation.](#)
 - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: 24 Gauge
 - b. Exterior Finish: Two-coat fluoropolymer.
 - c. Color: As selected by Architect from manufacturer's full range of standard colors.
 - 3. Panel Coverage: 12 inches (305 mm).
 - 4. Panel Height: 1.0 inch (25 mm).

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) 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. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: 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 EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types 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 (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; 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. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels 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. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal 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 Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. 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 soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 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. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. 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 (0.013 mm).

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 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 panel manufacturer.
 - 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
 - a. Verify that air- or water-resistive barriers 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 C754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

3.3 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.
 - 2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 - 3. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
 - 4. Stainless Steel Panels: Use stainless steel fasteners.
- 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 (152-mm) 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 (3 m) with no joints allowed within 24 inches (610 mm) 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 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 074293

SECTION 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyvinyl chloride (PVC) roofing system.
2. Accessory roofing materials.
3. Substrate board.
4. Vapor retarder.
5. Roof insulation.
6. Insulation accessories and cover board.
7. Asphalt materials.
8. Walkways.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
4. Section 077100 "Roof Specialties" for premanufactured copings.
5. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
7. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 CODE REQUIREMENTS

- A. The applicator shall submit evidence that the proposed roof system meets the requirements of the local building code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance, as required in the "Submittals" section of this specification.
- B. Factory Mutual Research Corporation (FM) - Norwood, MA.
1. Class 1-105 (attachment requirements only).
- C. Underwriters Laboratories, Inc. - Northbrook, IL.
1. Class A assembly for exterior fire exposure.

1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, 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 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.
- B. Preinstallation Roofing Conference: Conduct conference at Project site.
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, 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. 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.

1.5 ACTION SUBMITTALS

- A. Product Data:
1. Polyvinyl chloride (PVC) roofing system.
 2. Accessory roofing materials.
 3. Substrate board.
 4. Vapor retarder.
 5. Roof insulation.
 6. Insulation accessories and cover board.
 7. Walkways.

8. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
-
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation thickness and slopes. Tapered insulation layout plan
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with air barrier.
 - C. Samples for Verification: For the following products:
 1. Roof membrane and flashing, of color required.
 2. Walkway pads or rolls, of color required.
 - D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.
-
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer and manufacturer.
 - B. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
 - C. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.
 - D. Evaluation Reports: For components of roofing system, from ICC-ES.
 - E. Field Test Reports:
 1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
 - F. Field quality-control reports.
 - G. Sample Warranties: For manufacturer's special warranties.
-
- 1.7 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For roofing system to include in maintenance manuals.

- B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.8 QUALITY ASSURANCE

- A. This roofing system shall be applied only by a Roofing Contractor authorized by the Manufacturer prior to bid ("Applicator"). The Roofing Contractor shall have at least five (5) years of experience as an applicator with the submitted manufacturer as certified by the manufacturer.
- B. Upon completion of the installation and the delivery to the Manufacturer by the Applicator of a certification that all work has been done in strict accordance with the contract specifications and the Manufacturer's requirements, an inspection shall be made by a Technical Representative of the Manufacturer to review the installed roof system.
- C. There shall be no deviation made from the Project Specification or the approved shop drawings without prior written approval by the Owner, Architect, and the approved PVC Membrane Manufacturer.
- D. All work pertaining to the installation of the membrane and flashings shall only be completed by Applicator personnel trained and authorized by the Manufacturer in those procedures.
- E. Membrane to have no formulation changes in the last fifteen (15) years as certified by the manufacturer. No private labeled membrane products will be accepted or reviewed.

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.
- E. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material

manufacturer/supplier.

- F. All materials which are determined to be damaged by the Owner's Representative or the manufacturer are to be removed from the job site and replaced at no cost to the Owner.

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.
- B. Membrane materials may be installed under certain adverse weather conditions but only after consultation with the Manufacturer and Owner's Representative, as installation time and system integrity may be affected.
- C. Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be cleaned and heat welded before leaving the job site that day.
- D. All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
- E. All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to application.
- F. All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.
- G. Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.
- H. The Applicator is cautioned that certain membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with the membranes. The Applicator shall consult the manufacturer regarding compatibility, precautions and recommendations.
- I. Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over Felt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.
- J. Prior to and during application, all dirt, debris and dust shall be removed from surfaces

either by vacuuming, sweeping, blowing with compressed air and/or similar methods.

- K. The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.
- L. All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Applicator and properly transported to a legal dumping area authorized to receive such material.
- M. The Applicator shall take precautions that storage and/or application of materials and/or equipment does not overload the roof deck or building structure.
- N. Flammable adhesives and deck primers shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.
- O. Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be completed to the Owner's satisfaction.
- P. All landscaped areas damaged by construction activities shall be repaired at no cost to the Owner.
- Q. The Applicator shall conduct fastener pullout tests in accordance with the latest revision of the SPRI/ANSI Fastener Pullout Standard to help verify condition of deck/substrate and to confirm expected pullout values.
- R. Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odors could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused cans at all times.
- S. Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

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 roof membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, and other components of roofing system.
 - 2. The Warranty shall be Non-Prorated provide for No Dollar Limit (NDL), and shall not exclude ponding water and no time limited shall be assigned for any such ponding water during the warranty period.
 - 3. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: The Applicator shall supply the Owner with a separate five-year workmanship warranty. In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the Owner. The Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to the manufacturer.

1. 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 roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:
2. Warranty Period: Five years from date of Substantial Completion.

C. Owner Responsibility

1. Owner shall notify both the manufacturer and the Applicator of any leaks as they occur during the time period when both warranties are in effect.

1.12 SUBMITTALS OF EQUALS

- A. Proposed equals to be considered for use on this project will only be accepted during bid period. Proposed roof systems which have been reviewed and accepted will be listed in an addendum prior to bid closing date.
- B. Submittals shall include the following:
 1. Copies of Specification including physical prosperities.
 2. Samples of each primary component to be used in the roof system and the manufacturer's current literature for each component.
 3. Written approval by the insulation manufacturer (as applicable) for use and performance of the product in the proposed system.
 4. Sample copy of Manufacturer's warranty including no exclusion for ponding water and no time limit shall be assigned to any such ponding water.
 5. Sample copy of Applicator's warranty.
 6. Certifications by manufacturers of roofing and insulating materials that all materials supplied comply with all requirements of the identified ASTM and industry standards or practices and requirements of this specification.
 7. Certification from the Applicator that the system specified meets all identified code and insurance requirements as required by the Specification.
 8. Letter from the proposed manufacturer confirming the number of years it has DIRECTLY manufactured the proposed roof system under the trade names and/or trademarks as proposed. No private labeled products/membranes will be accepted or reviewed.
 9. Material Safety Data Sheets (MSDS).
- C. Thermoplastic-Polyolefin (TPO) roofing products are not an equal and will not be approved.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from roof membrane manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof

system and flashings to remain watertight.

1. Accelerated Weathering: Roof membrane to withstand 5,000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
- D. Energy Star Listing: Roofing system to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for low-slope roof products.
- E. Energy Performance: Roofing system to have an initial solar reflectance of not less than 0.73 and an emissivity of not less than 0.89 when tested in accordance with ANSI/CRRC S100.
- F. Exterior Fire-Test Exposure: ASTM E108 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.
- G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.3 POLYVINYL CHLORIDE (PVC) ROOFING SYSTEM

- A. PVC Sheet Type II: ASTM D4434/D4434M, glass-fiber reinforced, felt backed.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Sika Sarnafil G410-80 Feltback
 - b. Pre-approved substitution: Johns Manville JM PVC FB-80
 2. Thickness: 80 mils (2.0 mm).
 3. Exposed Face Color: Reflective gray.
 4. Typical Physical Properties:

Parameters	ASTM Test Method	Minimum ASTM Requirement	Sarnafil Typical Physical Properties
Reinforcing Material	-		Fiberglass
Overall Thickness, min. mil	D-751	45 mil	80 mil
Tensile Strength lpf (N)	D-751	55 lpf (245 N)	110 lbf (489 N)
Elongation at Break, min. (machine x tranverse)	D-751	250% / 220%	250% / 200%
Seam strength*, min. (% of tensile strength)	D-751	75%	Pass
Retention of Properties After Heat Aging			
Tensile Strength, min., (% of original)	D-3045	90%	Pass
Elongation, min., (% of original)	D-751	90%	Pass
Tearing Resistance, min., lbf/in (N)	D-751	10 lpf/in (45 N)	22 lpf/in (98 N)
Low Temperature Bend	D-2136	40° F (-40° C)	Pass
Accelerated Weathering Test (Xenon Arc)	G-154	5,000 Hours	10,000 Hours
Cracking (7x magnification)	-	None	None
Discoloration (by observation)	-	Negligible	Negligible
Crazing (7 x magnification)	-	None	None
Linear Dimensional Change	D-1204	0.10 %	-0.01%
Weight Change After Immersion in Water	D-570	± 3.0%	1.7%
Static Puncture Resistance	D-5602	33 lbf (15 kg)	Pass
Dynamic Puncture Resistance	D-5635	7.3 ft-lbf (10 J)	Pass
*Failure occurs through membrane rupture, not seam failure.			

2.4 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
- B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- C. Roof Vents: As recommended by roof membrane manufacturer.
 - 1. Size: Not less than 4-inch (100-mm) diameter.

- D. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
 - 1. Fasteners: 1-1/2-inch (38-mm) stainless steel fasteners with neoprene washers.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- F. 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 FLASHING MATERIALS

- A. Wall / Curb Flashings
 - 1. Sarnafil G410 Membrane
 - a. A fiberglass reinforced membrane adhered to approved substrate using adhesive.
 - b. Pre-approved substitution: Johns Manville JM PVC FB-80
 - 2. Sarnafil G459 Membrane
 - a. An asphalt-resistant, fiberglass reinforced membrane adhered to approved substrate using Sarnacol adhesive.
 - 3. Sarnaclad
 - a. A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Sarnaclad is a 25 gauge, G90 galvanized metal sheet with a 20 mil. (1 mm) membrane laminated on one side.
 - b. Pre-approved substitution: Johns Manville JM PVC Coated Metal
- B. Miscellaneous Flashing
 - 1. Sarnaflash
 - a. A prefabricated expansion joint cover made from Sarnafil membrane. Sarnaflash is designed for securement to vertical or horizontal surfaces to span and accommodate the movement of new and existing expansion gaps from 1 inch to 4-1/2 inches (25 mm to 114 mm) across. Available in 40 foot (12 m) rolls. Consult Product Data Sheet for additional information.
 - 2. Sarnareglet
 - a. A heavy-duty, extruded aluminum flashing termination reglet used at walls and large curbs. Sarnareglet is produced from 6063-T5, 0.10 inch to 0.12 inch (2.5 mm to 3.0 mm) thick extruded aluminum. Sarnareglet has a 2-1/4 inch (57 mm) deep profile, and is provided in 10 foot (3 m) lengths. Use prefabricated Sarnareglet mitered inside and outside corners where walls intersect. Consult Product Data Sheet for additional information.
 - 3. Sarnastack
 - a. A prefabricated vent pipe flashing made from 0.048 inch (48 mil/1.2 mm) thick Sarnafil G410 membrane. Available in five different sizes. Consult Product Data Sheet for sizes and additional information.
 - b. Pre-approved substitution: Johns Manville JM PVC Pipe Boots & Split Pipe Boots
 - 4. Sarnacircle – “G”
 - a. Circular 0.048 inch (48 mil/1.2 mm) thick G410 membrane patch welded over T-joints formed by overlapping thick membranes.

- b. Pre-approved substitution: Johns Manville JM PVC T-Joint Patch
- 5. Sarnacorners – Universal
 - a. Prefabricated outside and inside flashing corners made of 0.060 inch 60 mil/1.5 mm) thick membrane that are heat-welded to membrane or Sarnaclad base flashings. Available in one inside size and two outside sizes (5" and 8-1/2" diameter). Can be cut into one inside or one outside corner.
 - b. Pre-approved substitution: Johns Manville JM PVC Universal Corners
- 6. Multi-Purpose Sealant
 - a. A proprietary sealant used at flashing terminations.
- 7. Flashing Adhesive
 - a. A solvent-based reactivating-type adhesive used to attach membrane to flashing substrate.

2.6 ATTACHMENT COMPONENTS

A. Sarnacol 2121 Membrane adhesive

- 1. Water Based Adhesive: Field Membrane
 - a. A water-based adhesive used to attach the membrane to horizontal or near horizontal substrates. Application rates are as follows:

APPLICATION RATES FOR FELTBACK MEMBRANE						
	Adhesive Rates - Gallons/100 Ft² (Liters/Meter²)					Approximate Sq. Ft./Pail (meter²)
	Substrate		Membrane		Total	
Isocyanurate facer	1.75 (0.71)	+	0	=	1.75 (0.71)	285 (26.48)
Smooth plywood	1.75 (0.71)	+	0	=	1.75 (0.71)	285 (26.48)
Concrete deck	2.00 (0.81)	+	0	=	2.00 (0.81)	250 (23.23)
Cellular concrete	2.00 (0.81)	+	0	=	2.00 (0.81)	250 (23.23)
GP Dens-Deck®	1.75 (0.71)	+	0	=	1.75 (0.71)	285 (26.48)
GP Dens-Deck Prime®	1.50 (0.61)	+	0	=	1.50 (0.61)	333 (30.94)

- 2. Notes:
 - a. There is a significant increase in drying time due to an increase in humidity and/or a decrease in temperature. Do not install when outdoor or substrate temperatures during drying period are expected to fall below 40° F (5° C).
 - b. Do not allow 2121 adhesive to skin-over or surface-dry prior to installation of membrane.
 - c. Use a water-filled, foam-covered lawn roller to consistently and evenly press the membrane into the adhesive layer.
- 3. Pre-approved substitution: Johns Manville JM PVC Water Based Adhesive

B. SarnaFastener XP

- 1. A #15, heavy duty, corrosion resistant fastener used with peel-stop and bar to attach PVC membrane to steel or wood decks. Fastener XP has a shank diameter of approximately .21 inch (5.3 mm) and the thread diameter is approximately .26 inch (6.6 mm). The driving head has a diameter of approximately .435 inch (11 mm) with #3 Phillips recess to for positive engagement.

C. Sarnastop

1. An extruded aluminum, low profile bar used with certain Fasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate. Stop is a 1 inch (25 mm) wide, flat aluminum bar 1/8 inch (3 mm) thick that has predrilled holes every 6 inches (152 mm) on center.
 - a. Pre-approved substitution: Johns Manville JM Termination

D. Sarnafastener – Insulation Attachment

1. A #12 corrosion resistant fastener used with an insulation plate to attach insulation to wood or steel decks. Fastener #12 has a modified buttress thread, a shank diameter of approximately .168 inch and a thread diameter of approximately .214 inch. The driving head has a diameter of approximately .435 inch with a #3 Phillips recess for positive engagement.

E. Insulation Plate

1. Used with various fasteners to attach insulation boards to roof decks. Insulation plate is a 3 inch square or round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating,

2.7 SUBSTRATE BOARD

A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. **Products:** Subject to compliance with requirements, provide the following:
 - a. DensDeck Prime
2. Thickness: 1/2 inch (13 mm).
3. Surface Finish: Factory primed.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.8 VAPOR RETARDER

A. SBS Modified Bitumen Vapor Retarder:

1. **Products:** Subject to compliance with requirements, provide the following:
 - a. Sika Sarnafil SA 31
 - b. Pre-approved substitution: Johns Manville JM Vapor Barrier SAR
2. Thickness: 31 mils (0.8 mm).

B. Provide primer when recommended by vapor retarder manufacturer.

2.9 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured by PVC roof membrane manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, fiber reinforced felt facer on both major surfaces.

1. **Products:** Subject to compliance with requirements, provide the following:
 - a. Sika Sarnafil Sarnatherm ISO
 - b. Pre-approved substitution: Johns Manville ENRGY 3

2. Compressive Strength: 20 psi (138 kPa).
 3. Size: 48 by 96 inches (1219 by 2438 mm).
 4. Thickness:
 - a. Base Layer: 1-1/2 inches (38 mm).
 - b. Upper Layer: Tapered
- C. Tapered Insulation: Provide factory-tapered insulation boards.
1. Material: Match roof insulation.
 2. Minimum Thickness: 1/4 inch (6.35 mm).
 3. Slope:
 - a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

2.10 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
- D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
 1. **Products:** Subject to compliance with requirements, provide the following:
 - a. DensDeck Prime
 2. Thickness: 1/2 inch (13 mm).
 3. Dimensions: 48" x 48"
 4. Surface Finish: Factory primed.

2.11 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls
 1. **Products:** Subject to compliance with requirements, provide the following:
 - a. Sika Sarnafil Sarnatred-V
 - b. Pre-approved substitution: Johns Manville PVC Walkpad
 2. Thickness: 0.096" (2.4 mm)

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 053100 "Steel Decking."
4. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer, when tested according to ASTM F2170.
 - a. Test Frequency: One test probe per each 1000 sq. ft. (93 sq. m), or portion thereof, of roof deck, with no fewer than three test probes.
 - b. Submit test reports within 24 hours of performing tests.

- 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 system 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. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
 1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- 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 roof membrane and auxiliary materials to tie into existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints

staggered not less than 24 inches (610 mm) in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.
6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer (Sarnafil: All substrates except for steel). Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking:
 1. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows and with long joints continuous at right angle to flutes of decking.
 - a. Locate end joints over crests of decking.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

- 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
 - a. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - e. Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - g. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - h. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF COVER BOARDS

- A. 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 (150 mm) in each direction.
 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place. Weight down as required until complete adhesion is achieved.

3.8 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Accurately align roof membrane, and maintain uniform side and end laps of minimum

dimensions required by manufacturer. Stagger end laps.

- D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- E. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.
- F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
- I. Vertical Surfaces:
 - 1. Membrane extends 45 inches to 90 inches up wall face:
 - a. Provide one (1) termination bar full perimeter centered on membrane
 - 2. Membrane extends greater than 90 inches up wall face:
 - a. Provide two (2) termination bars full perimeter equally spaced on membrane.
 - 3. Comply with manufacturers recommendations for substitute membranes.

3.9 HOT-AIR WELDING OF SEAM OVERLAPS

- A. General
 - 1. All seams shall be hot-air welded. Seam overlaps should be 3 inches (75 mm) wide when automatic machine-welding and 4 inches (100 mm) wide when hand-welding, except for certain details.
 - 2. Welding equipment shall be provided by or approved by the manufacturer. All mechanics intending to use the equipment shall have successfully completed a training course provided by a Technical Representative prior to welding.
 - 3. All membrane to be welded shall be clean and dry.
- B. Hand-Welding
 - 1. Hand-welded seams shall be completed in two stages. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding.
 - 2. The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.
 - 3. The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow," the hand roller is positioned perpendicular to the nozzle and pressed lightly. For straight seams, the 1½ inch (40 mm) wide nozzle is recommended for use. For corners and compound connections, the ¾ inch (20 mm) wide nozzle shall be used.
- C. Machine Welding
 - 1. Machine welded seams are achieved by the use of automatic welding equipment. When using this equipment, the manufacturer's instructions shall be followed and

local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated off the generator.

2. Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

D. Quality Control of Welded Seams

2. The Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark grey material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator to locations as directed by the Owner's Representative or a manufacturer's representative. One inch (25 mm) wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

3.10 INSTALLATION OF BASE FLASHING

- 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,. Allow adhesive on substrate to fully dry, and on back of membrane allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or 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.

3.11 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch (76-mm) clearance between adjoining pads.
3. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.
4. Adhere center of walkways leaving all edges free of adhesive, then heat weld all edges.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
 1. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - c. Flood each area for 24 hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - e. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
 2. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.13 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 system 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 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall sheet metal fabrications.
 - 2. Miscellaneous sheet metal fabrications.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 075419 "Polyvinyl-Chloride (PVC) Roofing" for materials and installation of sheet metal flashing and trim integral with roofing.
 - 3. Section 077100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashings.
 - 4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 5. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.

1.2 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 roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Wall sheet metal fabrications.
 - 2. Miscellaneous sheet metal fabrications.
- B. Product Data Submittals:
 - 1. Underlayment materials.
 - 2. Elastomeric sealant.
 - 3. Butyl sealant.
 - 4. Epoxy seam sealer.
- C. 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 roof-penetration flashing.
8. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
9. Include details of special conditions.
10. Include details of connections to adjoining work.
11. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).

- D. Samples: For each exposed product and for each color and texture specified, 12 inches (300 mm) long by actual width.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For copings and roof edge flashing, from ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.
- E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

1.6 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. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop is to be listed as able to fabricate required details as tested and approved.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.

2. 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. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 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.

1.8 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows 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 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to 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 are not to rattle, leak, or loosen, and are to remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. 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 in accordance with ASTM A653/A653M, G90 (Z275) coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Color:
 - a. At insulated metal panel roofs: Match roof color
 - b. At soffit panels: Match soffit panel color
 - c. At wall panels: Match wall panel color
 - d. At CMU block walls: Grey or tan to match adjacent block
 - 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 (0.013 mm).

2.3 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, solder, 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 or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - 2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
- C. Solder:
 - 1. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.

- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

2.4 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 2. 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.
 - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 4. 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.
 - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
 - 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- 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 (25 mm) 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. Tin edges to be seamed, form seams, and solder.
 - 2. 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 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Materials: Use insulated metal roof panel manufacturer's trim. If no trim exists, provide trim from Galvanized Steel: 0.022 inch (0.56 mm) thick.
 - 1. Apron, Step, Cricket, and Backer Flashing
 - 2. Valley Flashing
 - 3. Drip Edges
 - 4. Eave, Rake, Ridge, and Hip Flashing
 - 5. Counterflashing: Shop fabricate interior and exterior corners.
 - 6. Flashing Receivers
 - 7. Roof-Penetration Flashing

2.6 WALL SHEET METAL FABRICATIONS

- A. Use insulated metal wall panel manufacturer's trim at wall panels.
- B. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings; and form with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch (0.56 mm) thick.
- C. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high, end dams. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.022 inch (0.56 mm) thick.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch (0.71 mm) thick.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:

1. Galvanized Steel: 0.040 inch (1.02 mm) 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. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than 12 inches (300 mm) o.c.
 6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 7. Do not field cut sheet metal flashing and trim by torch.
 8. 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.
 1. Coat concealed side of uncoated-aluminum and stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance Insert size requirement.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
1. Pretin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pretinning where pretinned surface would show in completed Work.
 2. Do not pretin zinc-tin alloy-coated copper.
 3. Do not use torches for soldering.
 4. Heat surfaces to receive solder, and flow solder into joint.
 - a. Fill joint completely.
 - b. Completely remove flux and spatter from exposed surfaces.
- H. Rivets: Rivet joints in zinc where necessary for strength.

3.3 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements, insulated metal panel manufacturer's written installation instructions, and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.

2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches (100 mm) over base flashing.
3. Lap counterflashing joints minimum of 4 inches (100 mm).
4. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.4 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

C. Reglets: Installation of reglets is specified in Section 077100 "Roof Specialties."

3.5 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans:

1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
2. Pipe and install drain line to plumbing waste or drainage system.

3.6 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

3.8 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. 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, as determined by Architect.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Roof-edge specialties.
 - 3. Roof-edge drainage systems.
 - 4. Reglets and counterflashings.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
 - 3. Section 077129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
 - 4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 5. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Copings.
 - 2. Roof-edge specialties.
 - 3. Roof-edge drainage systems.
 - 4. Reglets and counterflashings.
- B. Product Data Submittals: For each product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. 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.
- D. Samples: For each type of roof specialty and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.

- B. Product Test Reports: For copings, for tests performed by a qualified testing agency.
- C. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 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 roof edge, including coping, conductor, and downspout, approximately 10 feet (3.0 m) long, including supporting construction, seams, attachments, and accessories.
 - 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 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.

1.7 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.

1.8 WARRANTY

- A. 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. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties to 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. SPRI Wind Design Standard: Manufacture and install copings tested in accordance with SPRI ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: As indicated on Drawings.
- 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 10 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
 - 1. Basis-of-Design: Sika Wall Grip Coping
 - 2. Metallic-Coated Steel Sheet Coping Caps: Zinc-coated (galvanized) steel, nominal 0.028-inch (0.71-mm) thickness.
 - a. Surface: Smooth, flat finish.
 - b. Finish: Two-coat fluoropolymer.
 - c. Color: Tan to match adjacent CMU block.
 - 3. Corners: Factory mitered and continuously welded.
 - 4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.
 - a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

- A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
 - 1. Zinc-Coated Steel: Nominal 0.034-inch (0.86-mm) thickness.
 - 2. Gutter Profile: Style F in accordance with SMACNA's "Architectural Sheet Metal Manual."
 - a. Alternate: Insulated metal roof panel manufacturer's standard profile
 - 3. Minimum Dimensions:
 - a. Standard gutters: 4" wide x 3" deep

- b. Oversized Gutters: 6" wide x 5" deep
 - 4. Corners: Factory mitered and mechanically clinched and sealed watertight.
 - 5. Gutter Supports: Gutter brackets or straps with finish matching the gutters.
 - 6. Gutter Accessories: Continuous hinged leaf guard of solid metal designed to shed leaves.
- A. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 - 1. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
 - 2. Size: As indicated on drawings.
 - a. 4" x 3"
 - b. 6" x 6"
 - 3. Hangers: 1/16" x 1" minimum flat stock of same material and finish as downspout.
 - a. Space hangers not more than 10' o.c. with 2 hangers per downspout minimum
- B. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof.
 - 1. Basis-of-Design: Sika Sarnaclad Thru-Wall Scupper
 - 2. Or equal
 - 3. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
- C. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim, and built-in overflow.
 - 1. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
- D. Zinc-Coated Steel Finish:
 - 1. Gutters, Downspouts and Conductor Heads
 - a. Two-coat fluoropolymer.
 - b. Color: Match roof panels.
 - 2. Parapet Scuppers
 - a. PVC Membrane cladding matching roof membrane

2.4 REGLETS AND COUNTERFLASHINGS

- A. Source: Insulated metal roof panel manufacturer.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
 - 1. Zinc-Coated Steel: Nominal 0.022-inch (0.56-mm) thickness.
 - 2. Corners: Factory mitered and continuously welded.
 - 3. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
- C. 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:

1. Zinc-Coated Steel: Nominal 0.022-inch (0.56-mm) thickness.

D. 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.

E. Zinc-Coated Steel Finish: Three-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

2.5 MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

2.6 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 in accordance with ASTM A153/A153M or ASTM F2329.

- B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

2.7 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.

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. Install roof specialties in accordance with 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. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
 - 1. Space movement joints at a maximum of 10 feet with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
 - 2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- C. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- D. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- E. 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 (4 deg C).

3.3 INSTALLATION OF COPINGS

- 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 INSTALLATION OF ROOF-EDGE SPECIALITIES

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.5 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

- A. Install components to produce a complete roof-edge drainage system in accordance with manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
 - 1. Provide elbows at base of downspouts at grade to direct water away from building.
 - 2. Connect downspouts to underground drainage system indicated.
- C. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - 1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
 - 2. Seal or solder exterior wall scupper flanges into back of conductor head.
- D. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch (25 mm) below scupper discharge.

3.6 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

- A. Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Embedded Reglets: See Section 042000 "Unit Masonry" for installation of reglets.
- C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.7 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 077100

SECTION 077129 - MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flanged bellows-type roof expansion joints.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.
 - 3. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for expansion joints in walls.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Extruded bellows roof expansion joints.
- B. Shop Drawings: For roof expansion joints.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
 - 3. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.
- C. Samples: For each exposed product and for each color specified, 6 inches (150 mm) in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of roofing membrane.

1.6 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Matching that of Roofing Membrane

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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 seals, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Fire-Resistance Rating: Comply with ASTM E1966 or UL 2079; testing by a qualified testing agency to resist the spread of fire and to accommodate building thermal and seismic movements without impairing its ability to resist the passage of fire and hot gases. Identify products with appropriate markings of applicable testing agency.
 - 1. Rating: Not less than fire-resistance rating of the roof assembly.
 - 2. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 FLANGED BELLOWS-TYPE ROOF EXPANSION JOINTS

- A. Flanged Bellows-Type Roof Expansion Joint: Factory-fabricated, continuous, waterproof, joint cover consisting of exposed membrane bellows laminated to flexible, closed-cell support foam, and secured along each edge to 3- to 4-inch- (76- to 100-mm-) wide metal flange.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide inpro Corporation; 672-G02-150 or a comparable product by one of the following:
 - a. Balco; a CSW Industrials Company.
 - b. Construction Specialties, Inc.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. **MM Systems: ERJL-600**
 - 2. Source Limitations: Obtain flanged bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.
 - 3. Joint Movement Capability: Plus and minus 50 percent of joint size.
 - 4. Bellows: EPDM flexible membrane, nominal 60 mils (1.5 mm) thick.
 - 5. Flanges: Galvanized steel, 0.022 inch (0.56 mm) thick.
 - 6. Configuration: Flat to fit cants as indicated on Drawings.
 - 7. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.

8. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.

B. Materials:

1. Galvanized-Steel Sheet: ASTM A653/A653M, hot-dip zinc-coating designation G90 (Z275).
2. EPDM Membrane: ASTM D4637/D4637M, type standard with manufacturer for application.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: As recommended by roof-expansion-joint manufacturer.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.
- C. Mineral-Fiber Blanket: ASTM C665.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joint openings, substrates, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions for handling and installing roof expansion joints.
 1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
 2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 3. Provide for linear thermal expansion of roof-expansion-joint materials.
 4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
 5. Provide uniform, neat seams.
 6. Install roof expansion joints to fit substrates and to result in watertight performance.
- B. Directional Changes: Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.
- C. Transitions to Other Expansion-Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion-control joint assemblies specified in

Section 079513.16 "Exterior Expansion Joint Cover Assemblies" to result in watertight performance. Install factory-fabricated units at transitions between roof expansion joints and exterior expansion-control joint systems.

- D. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.

END OF SECTION 077129

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof curbs.
 - 2. Equipment supports.
 - 3. Roof hatches.
 - 4. Pipe and duct supports.
- B. Related Requirements:
 - 1. Section 075419 "Polyvinyl-Chloride (PVC) Roofing" for preformed and field-formed PVC membrane flashing.
 - 2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing and miscellaneous sheet metal trim and accessories.
 - 3. Section 077100 "Roof Specialties" for manufactured fasciae, copings, gutters and downspouts, and counterflashing.
 - 4. Section 077129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint covers.
 - 5. Section 233423 "HVAC Power Ventilators" for power roof-mounted ventilators.
 - 6. Section 237423.13 "Packaged, Direct-Fired, Outdoor, Heating-Only Makeup-Air Units" for standard curbs specified with rooftop units.

1.2 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.

1.3 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.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.5 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 Delta E 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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories to 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 CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.
- D. Steel: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) thick.
 1. Finish: Baked enamel or powder coat.
 2. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
 1. Curb Profile: Profile as indicated on Drawings compatible with roofing system.
 2. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
 3. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or by use of leveler frame.
 4. Insulation: Factory insulated with 2 inch thick glass-fiber board insulation.
 5. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 6. Nailer: Factory-installed wood nailer under top flange on side of curb, continuous around curb perimeter.
 7. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- (19-mm-) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.

8. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced perimeter metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, and integrally formed structure-mounting flange at bottom.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.
- D. Steel: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) thick.
 1. Finish: Baked enamel or powder coat.
 2. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
 1. Curb Profile: Profile as indicated on Drawings compatible with roofing system.
 2. Insulation: Factory insulated with 2 inch thick glass-fiber board insulation.
 3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
 4. Nailer: Factory-installed continuous wood nailers 3-1/2 inches (90 mm) wide under top flange on side of curb, continuous around support perimeter.
 5. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- (19-mm-) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 6. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
 7. Fabricate equipment supports to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

2.4 ROOF HATCHES

- 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, straight sides, 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:
 - a. ACUDOR Products, Inc.
 - b. Babcock-Davis.
 - c. BILCO Company (The).

B. Type and Size:

1. Single-leaf lid, 30 by 36 inches (750 by 900 mm).

C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) Insert value external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

D. Hatch Material, Steel: Zinc-coated (galvanized) steel sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
2. Finish: Two-coat fluoropolymer.
3. Color: Manufacturer's Standard.

E. Construction:

1. Insulation: 2-inch- (50-mm-) thick, polyisocyanurate board.
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. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

F. Hardware: Spring operators, hold-open arm, steel spring latch with turn handles, steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches (1060 mm) above finished roof deck.
3. Material: Steel tube.
4. Post: 1-5/8-inch- (41-mm-) diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.
 - a. Color: Manufacturer's Standard

2.5 PIPE AND DUCT SUPPORTS

A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch- (38-mm-) diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

B. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches (50 mm) in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.

1. Finish: Manufacturer's standard.

2.6 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.
 - 1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).
 - 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 (0.013 mm).
- B. Aluminum Extrusions and Tubes: ASTM B221 (ASTM B221M), 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 A500/A500M, round tube.
- F. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.
- G. Steel Pipe: ASTM A53/A53M, galvanized.

2.7 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C), thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWWPA C2; not less than 1-1/2 inches (38 mm) thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

- F. 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.
- G. Elastomeric Sealant: ASTM C920, elastomeric polyurethane 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.
- H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.8 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. 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. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

F. 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 077200

SECTION 077253 - SNOW GUARDS

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. Rail-type, flat-mounted snow guards.

1.3 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for snow guards.
- B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
 - 1. Include details of rail-type snow guards.
 - 2. Include calculation of number and location of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.
- C. Samples: Base, bracket, and 12-inch- (300-mm-) long rail.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of snow guard, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Manufacturer to design snow guards system, including attachment to roofing material and roof deck, as applicable for attachment method, based on the following:
 - 1. Roof snow load.
 - 2. Snow drifting
 - 3. Roof slope.
 - 4. Roof type.
 - 5. Roof dimensions.
 - 6. Roofing substrate type and thickness.
 - 7. Snow guard type.
 - 8. Snow guard fastening method and strength.
 - 9. Snow guard spacing.
 - 10. Coefficient of Friction Between Snow and Roof Surface: 0.

- B. Refer to drawings for locations to be protected.
- C. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Structural Performance:
 - 1. Snow Loads: As indicated on Drawings.

2.2 RAIL-TYPE SNOW GUARDS

- A. Flat-Mounted, Rail-Type Snow Guards:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide S-5! Metal Roof Innovations, Ltd. ; DualGard. or a comparable product by one of the following:
 - a. Alpine SnowGuards.
 - b. Rocky Mountain Snow Guards, Inc.
 - c. TRA Snow and Sun, Inc.
 - 2. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with two rails.
 - 3. Brackets: ASTM B221 (ASTM B221M) aluminum.
 - 4. Bars and Couplings: ASTM B221 (ASTM B221M) aluminum.
 - a. Profile: Round.
 - 5. Seam Clamps: ASTM B221 (ASTM B221M) aluminum extrusion or ASTM B85/B85M aluminum casting with stainless steel set screws incorporating round nonpenetrating point; designed for use with applicable roofing system to which clamp is attached.
 - 6. Endcaps: Metal
 - 7. Color: Custom Powdercoat to match roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
 - 1. Verify compatibility with and suitability of substrates including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install snow guards according to manufacturer's written instructions. Space rows as recommended by manufacturer.

- B. Attachment for Standing-Seam Metal Roofing:
 - 1. Do not use fasteners that will penetrate metal roofing or fastening methods that void metal roofing finish warranty.
 - 2. Rail-Type, Seam-Mounted Snow Guards:
 - a. Install brackets to vertical ribs in straight rows.
 - b. Secure with stainless steel set screws, incorporating round nonpenetrating point, on same side of standing seam.
 - c. Torque set screw in accordance with manufacturer's written instructions.
 - d. Install cross members to brackets.

END OF SECTION 077253

SECTION 078100 - APPLIED FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sprayed fire-resistive materials.
- B. Related Requirements:
 - 1. Section 078123 "Intumescent Fire Protection" for mastic and intumescent fire-resistive coatings.

1.2 DEFINITIONS

- A. SFRM: Sprayed fire-resistive materials.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. Sprayed fire-resistive materials.
 - 2. Substrate primers.
 - 3. Bonding agent.
 - 4. Metal lath.
 - 5. Reinforcing fabric.
 - 6. Reinforcing mesh.
 - 7. Sealer.
 - 8. Topcoat.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
 - 1. Extent of fire protection for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum sprayed fire-resistive material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of sprayed fire-resistive material after application.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of sprayed fire-resistive material.
- C. Evaluation Reports: For sprayed fire-resistive material, from ICC-ES.

D. Preconstruction Test Reports: For fire protection.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

1. Build mockup of each type of fire protection and different substrate and each required finish as shown 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.

C. It is recommended that industry guidelines as noted in National Fireproofing Contractors Association (NFCA) 100 – Standard Practice for the Application of Spray-Applied Fire Resistive Materials (SFRMs) be maintained on the project site.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on fire protection.

1. Provide test specimens and assemblies representative of proposed materials and construction.

B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength in accordance with ASTM E736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Density: Test for density in accordance with ASTM E605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with sprayed fire-resistive material.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain sprayed fire-resistive material manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 44 deg F (7 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fire protection from single source.
- C. Fire-Resistance Design: Tested in accordance with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
 - 2. Required rating: 60 minutes (1 hour)
- D. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Isolatek International; Cafco 300 Series or a comparable product by one of the following:
 - a. GCP Applied Technologies Inc. MK-6/HY
 - b. **Carbolite Global: Southwest Fireproofing Type 5GP**
 - 2. Physical Properties:
 - a. Bond Strength: Minimum 150-lbf/sq. ft. (7.18-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
 - b. Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) as specified in the approved fire-resistance design, according to ASTM E 605.
 - c. Combustion Characteristics: When tested in accordance with ASTM E 136 shall be noncombustible.

- d. Surface-Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following surface burning characteristics:
 - 1) Flame Spread Index [10] or less
 - 2) Smoke Developed [10] or less
 - e. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 1,440 psf (68.9 kPa).
 - f. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
 - g. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 - h. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
 - i. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
 - j. Fungal Resistance: When tested in accordance with ASTM G21, the material shall show resistance to mold growth for a minimum period of 28
- 3. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 1.4375 inch (37 mm).
 - a. GCP Applied Technologies Inc. MK-6/HY: not less than 1.5625 inch.
 - b. **Carbolite Global: Southwest Fireproofing Type 5GP: not less than 1.5 inch.**
 - 4. Finish: Spray-textured finish.
 - a. Below 10 feet above finish floor and at other locations where physical contact with sprayed fire-resistive material may occur: Apply separate, topcoat after finishing.

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:
 - 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests in accordance with ASTM E736.
- C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, in accordance with fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.
- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.
- G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
 - 1. Product: Subject to compliance with requirements, provide CAFCO® BOND-SEAL (ISOLATEK® Type EBS) or CAFCO® BOND-SEAL Type X (ISOLATEK® Type X) by ISOLATEK International.
- H. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
 - 1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.
 - a. Product: Subject to compliance with requirements, provide CAFCO® FENDOLITE® M-II (ISOLATEK® Type M-II), CAFCO® FENDOLITE® TG (ISOLATEK® Type TG) by ISOLATEK International.
 - 2. Water-Based Permeable Topcoat: Factory-mixed formulation for brush, roller, or spray application over applied SFRM. Provide application at a rate of 60 sq. ft./gal. (1.5 sq. m/L).
 - a. Product: Subject to compliance with requirements, provide CAFCO® TOP-COTE (ISOLATEK® Type TOP-COTE) by ISOLATEK International.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.
 - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
 - 2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

- B. Verify that concrete work on steel deck is complete before beginning Work.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.
- D. Conduct tests in accordance with sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.
- B. Clean substrates of substances that could impair bond of fire protection.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fire protection Work.
- B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
 - 1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
- D. Metal Decks:

1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
 2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.
- E. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.
- F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.
- G. Extend fire protection in full thickness over entire area of each substrate to be protected.
- H. Install body of fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.
- I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fire protection that differs in color from that of encapsulant over which it is applied.
- J. Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.
- K. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.
- L. Cure fire protection in accordance with sprayed fire-resistive material manufacturer's written instructions.
- M. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.
- N. Finishes: Where indicated, apply fire protection to produce the following finishes:
1. Manufacturer's Standard Finishes: Finish in accordance with manufacturer's written instructions for each finish selected.
 2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
 3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
 4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.
 5. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials."
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fire protection will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fire protection that does not pass tests and inspections, and retest.
 - 2. Apply additional fire protection, in accordance with manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.5 CLEANING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

- A. Protect fire protection, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.7 REPAIRS

- A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.
- B. Repair fire protection damaged by other work before concealing it with other construction.
- C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100



the standard in safety

Underwriters
Laboratories

July 16, 2008

Mr. Rudy Jagnandan
Sr. Development Engineer
Isolatek International
41 Furnace Street
Stanhope, NJ 07874

Our Reference: R3749; 08NK16981

Dear Mr. Jagnandan:

This is in response to your request that Underwriters Laboratories, Inc. (UL) undertake an investigation to summarize fire test data pertaining to the thermal transmission properties of your Types 300, 300ES, 300N or SB Spray-Applied Fire Resistive Material (SFRM) when applied to expanded metal lath substrates.

Thermal transmission properties were developed through engineering studies and small-scale testing. The small scale test samples were 4 ft. by 4 ft. with 3/8 in. expanded metal lath weighing 2.5 lb./sq. yd. applied directly to steel framing. The tests were conducted under Projects 08CA06090 and 96NK34305.

The Type 300 SFRM was applied to the metal lath at various thicknesses. Thermocouples were placed on the unexposed surface of the assemblies to measure temperature rise. The small-scale samples were tested on UL's small scale horizontal furnace with temperatures controlled in accordance with the UL 263 time temperature curve. These tests were conducted to establish the time at which the temperature on the unexposed surface was raised an average of 250 °F over the surface or 325 °F at an individual location.

Test data was studied to develop equations for predicting the thickness of material required to maintain an average temperature of 250 °F over the unexposed surface or 325 °F at an individual location, at specific hourly rating periods. The following table has been developed based on these equations.

Thickness of Types 300, 300ES, 300N or SB Spray-Applied Fire Resistive Material (SFRM) Applied over Metal Lath Surface					
Hourly Rating	1 hr.	1-1/2 hr.	2 hr.	3 hr.	4 hr.
Thickness (in.)	1-7/16	2	2-5/8	3-5/16	4-3/16

Authorities having jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Listed or Classified products, equipment, systems, devices and materials.

Only those products bearing the appropriate Classification Marking and the company's name, trade name, trademark, or other recognized identification should be considered as covered by UL's Classification and Follow-Up Service. Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories, Inc. (UL) or any authorized licensee.

We trust the above answers your inquiry. However, if you should have any questions, please contact the undersigned.

Very truly yours,



MARK IZYDOREK
Lead Engineering Associate
Fire Protection Division

Reviewed By:



FREDERICK E. HERVEY
Section Manager II
Fire Protection Division



July 18, 2007

TITLE: Thermal Transmission Testing of Southwest 5GP by the ASTM E119 Fire Time/Temperature Curve

REFERENCE: L535-60, L643-5, L643-6, L643-7

DOCUMENT ACCESS NO.: 09642

PURPOSE: To determine the thermal transmission of Southwest 5GP when applied at various thicknesses and exposed to the ASTM E119 fire time/temperature curve.

CONCLUSIONS: The following thicknesses of Southwest 5GP will reach 250 °F above ambient at:

30 minutes	1 inch
1 hour	1-9/16 inches
1½ hours	2 inches
2 hours	2-5/16 inches
2½ hours	2-5/8 inches
3 hours	2-15/16 inches

PROCEDURE:

I. Systems

A. Galvanized steel panels 26½" x 26½" x 1/16".

B. Southwest 5GP @ 1 inch, 2 inches, 3 inches.

II. Application

A. Solvent wipe the panels to clean and degrease them.

B. Spray apply Southwest 5GP to one side at the indicated thicknesses and trowel smooth.

C. Cure 11 months at 70-80 °F and 40-80% relative humidity.

III Fire Testing

A. Expose the specimen to the ASTM E119 fire time/temperature curve on the Carboline beam furnace.

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The technical data furnished are true and accurate to the best of our knowledge
However, no guarantee of accuracy is given or implied.



- B. The temperature of the unexposed side was measured by thermocouples placed at the center of the panels and at the center of each quadrant made by dividing the panel into four equal areas. Thermocouples are 20 gage type K thermocouple wire with the leads stripped and twisted together. They are held on the steel by 2 pound weights with a 10 square inch insulating pad.
- C. Time to an average thermocouple reading of 250°F above ambient or a single thermocouple at 325°F above ambient was recorded.

RESULTS:

Thickness (inches)	Endpoints	
	Time to 250°F + ambient average (minutes)	Time to 325°F + ambient single point (minutes)
1	31	32
2	90	102
3	191	215



Jon Furlong
Advanced Chemist
Carboline Company

From the Carboline Research & Development Laboratory

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Table I**Fire Test Temperatures of the 1 Inch Panel**

Thermal Transmission of Southwest 5GP
 SW5GP @ 1" on galvanized 1/16" panel
 Time is 09:17:12.65.
 Date is 6-27-2007.

Project: L535-60
 Burn Ref.: L643-5
 Ambient: 79°F

Time (hr:min)	Specimen Temperatures (°F)						Furnace Average (°F)
	Average	Spec #1	Spec #2	Spec #3	Spec #4	Spec #5	
0:00	71	77	71	74	77	58	69
0:02	77	77	77	77	79	77	426
0:04	87	84	88	90	88	87	975
0:06	117	111	117	122	118	116	1093
0:08	143	135	142	147	145	143	1022
0:10	155	149	154	159	160	154	1181
0:12	171	165	167	172	175	174	1337
0:14	181	176	177	182	185	183	1404
0:16	184	181	182	187	186	185	1361
0:18	187	182	184	187	191	190	1340
0:20	190	187	188	189	193	194	1389
0:22	196	189	204	202	194	192	1459
0:24	213	198	229	232	211	193	1491
0:26	236	221	257	258	237	208	1518
0:28	269	245	297	303	268	233	1540
0:30	308	277	342	355	309	259	1561
0:32	353	319	388	408	353	297	1583
0:34	396	364	424	452	391	348	1573
0:36	434	403	457	488	433	389	1588
0:38	468	443	485	520	465	427	1600
0:40	496	470	509	548	490	462	1614
0:42	522	499	532	572	514	492	1628
0:44	543	523	551	593	533	514	1639
0:46	562	544	565	610	554	538	1652
0:48	577	563	578	626	565	554	1663
0:50	590	578	586	635	578	571	1674
0:52	602	596	592	645	589	586	1683
0:54	611	610	596	650	598	600	1693
0:56	616	615	597	654	604	612	1701
0:58	621	625	599	653	608	622	1712
1:00	623	629	599	650	608	629	1724

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Table II**Fire Test Temperatures of 2 Inch Panel**

Thermal Transmission of Southwest 5GP
 SW5GP @ 2" on galvanized 1/16" panel
 Time is 13:55:09.79.
 Date is 6-28-2007.

Project: L535-60
 Burn Ref.: L643-6
 Ambient: 78°F

Time (hr:min.)	Specimen Temperatures (°F)						Furnace Average (°F)
	Average	Spec #1	Spec #2	Spec #3	Spec #4	Spec #5	
0:00	79	77	82	79	79	77	83
0:05	79	78	79	78	82	78	1099
0:10	91	92	88	91	89	92	1293
0:15	123	125	119	123	120	127	1375
0:20	149	151	145	148	148	155	1473
0:25	166	170	161	165	163	170	1511
0:30	175	177	169	175	175	179	1551
0:35	179	178	178	179	177	184	1575
0:40	181	183	177	183	180	184	1602
0:45	184	183	179	186	184	188	1639
0:50	186	187	182	185	185	189	1663
0:55	188	190	184	188	187	192	1691
1:00	192	193	191	191	189	197	1715
1:05	192	192	188	192	192	196	1718
1:10	202	208	200	197	201	204	1735
1:15	227	237	222	224	225	229	1752
1:20	253	260	247	254	250	253	1766
1:25	289	298	282	294	282	287	1782
1:30	330	339	324	341	319	328	1796
1:35	362	371	352	371	352	366	1807
1:40	384	394	376	383	377	391	1820
1:45	407	417	400	405	399	415	1816
1:50	420	430	410	417	413	432	1818
1:55	434	442	425	431	429	445	1847
2:00	448	455	439	444	446	455	1822
2:05	458	463	448	455	454	468	1822
2:10	466	471	453	463	467	476	1825
2:15	473	473	461	473	474	485	1834
2:20	480	483	466	478	482	491	1842
2:25	485	484	473	485	488	497	1904
2:30	489	484	472	489	496	501	1886

From the Carboline Research & Development Laboratory

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Table III

Fire Test Temperatures of 3 Inch Panel

Thermal Transmission of Southwest 5GP
 SW5GP @ 3" on galvanized 1/16" panel
 Time is 11:51:30.61.
 Date is 6-29-2007.

Project: L535-60
 Burn Ref.: L643-7
 Ambient: 78°F

Time (hr:min.)	Specimen Temperatures (°F)					Furnace Average	
	Average	Spec #1	Spec #2	Spec #3	Spec #4		Spec #5
0:00	74	74	76	73	75	74	81
0:05	74	77	74	75	74	74	1092
0:10	75	73	75	77	76	75	1254
0:15	78	79	77	78	77	80	1327
0:20	89	93	86	89	87	91	1437
0:25	110	115	106	109	108	110	1480
0:30	130	135	126	132	126	130	1557
0:35	144	147	139	145	143	145	1605
0:40	153	157	149	157	149	155	1610
0:45	160	162	157	162	156	162	1630
0:50	165	167	162	167	162	167	1655
0:55	168	169	169	171	164	168	1677
1:00	170	171	168	174	165	171	1697
1:05	172	173	170	175	170	172	1721
1:10	173	173	172	177	170	173	1739
1:15	175	175	174	176	175	173	1757
1:20	176	177	173	176	176	178	1757
1:25	179	182	176	184	173	180	1770
1:30	179	182	177	183	177	177	1788
1:35	180	182	179	184	176	179	1800
1:40	182	183	182	185	182	181	1811
1:45	185	188	183	187	181	184	1824
1:50	186	188	187	188	183	185	1836
1:55	188	191	188	193	184	186	1847
2:00	189	190	190	190	185	188	1856
2:05	189	191	188	192	185	192	1869
2:10	190	191	190	194	186	191	1879
2:15	191	192	190	194	187	192	1888
2:20	193	201	189	194	186	192	1899
2:25	197	209	199	198	190	192	1907
2:30	204	217	202	204	197	199	1916
2:35	214	231	211	218	204	205	1892
2:40	228	246	225	235	216	219	1890
2:45	244	261	241	252	228	238	1896
2:50	259	282	253	269	241	249	1904
2:55	277	301	265	294	256	266	1911
3:00	293	319	284	305	268	290	1906
3:05	309	335	294	324	284	308	1909
3:10	324	349	308	339	297	327	1914
3:15	338	362	321	354	311	340	1915
3:20	349	375	332	366	320	353	1922
3:25	359	384	344	374	318	374	1926
3:30	368	393	355	385	324	382	1958
3:35	376	403	362	391	333	391	1972
3:40	383	409	371	399	339	400	1985

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3:45	389	414	376	408	346	400	1978
3:50	395	421	382	415	350	407	1971
3:55	402	427	392	425	355	410	1964
4:00	406	431	394	431	362	415	2013
4:05	413	439	399	437	367	420	2034
4:10	417	445	406	443	368	423	2039
4:15	418	445	406	447	373	420	2041
4:20	423	449	412	455	375	422	2046
4:25	429	457	412	466	383	424	2051
4:30	433	460	417	478	384	426	2057
4:34	438	464	425	482	391	429	2062

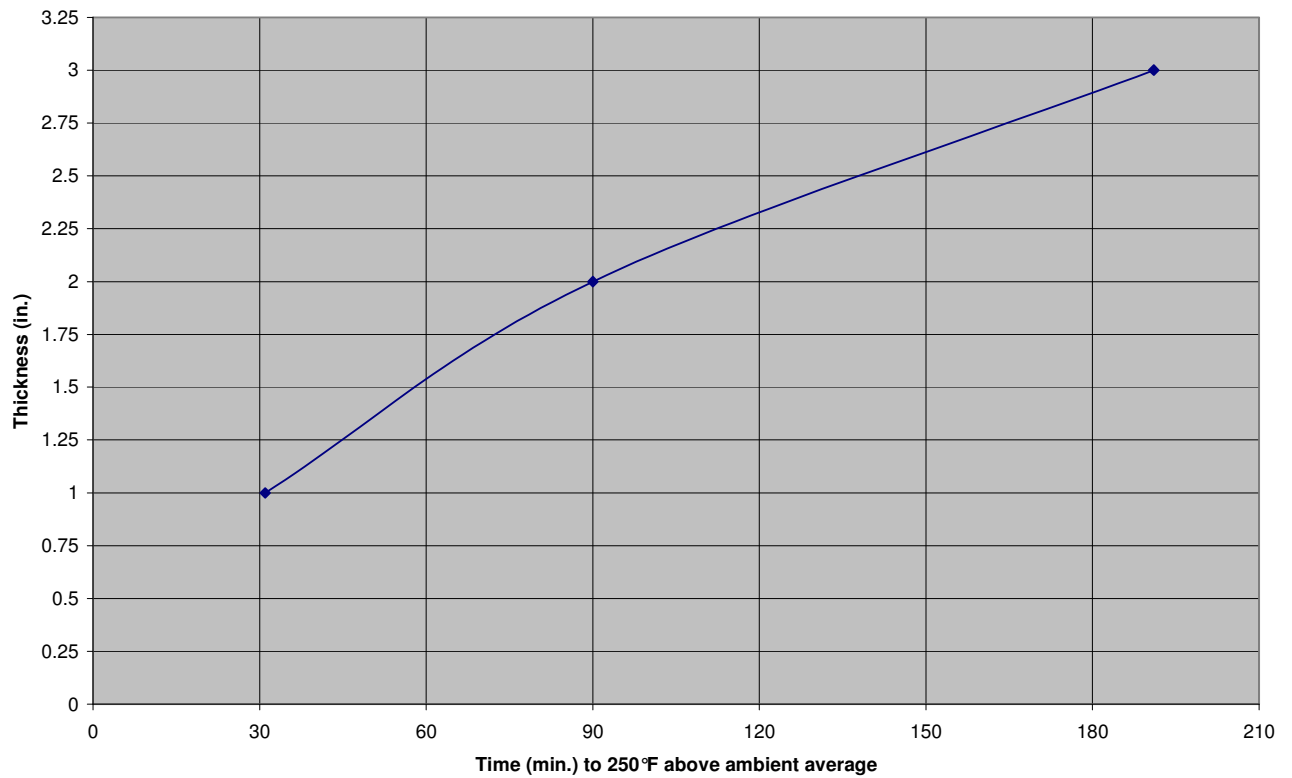
From the Carboline Research & Development Laboratory

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Graph I

Thermal Transmission of Southwest 5GP



From the Carboline Research & Development Laboratory

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However, no guarantee of accuracy is given or implied.





Mr. John Dalton
Technical Services Manager
GCP Applied Technologies
62 Whittemore Avenue
Cambridge, MA 02140

Our Reference: File R4339, Project 07NK13116 and 4787390697.

April 15, 2016

Dear Mr. Dalton,

This is in response to your request that Underwriters Laboratories summarize the test data and analysis of the thermal transmission properties for specific UL Classified Spray Applied Fire Resistant Materials (SFRM) manufactured by GCP Applied Technologies when applied to various substrates

Thermal transmission properties were developed through a series of small-scale tests and engineering studies conducted under Projects 88NK20217, 92NK00462 and 99NK21800. Test samples were 3 ft. by 3 ft. with 3/8 in. expanded metal lath weighing 2.5 lb/sq. yd. applied directly to framing, applied to 26 MSG steel fluted deck and applied to 1/4 in. thick steel plate. SFRM was applied to the metal lath at various thicknesses.

Thermocouples were placed on the unexposed surface of the assemblies to measure temperature rise. Samples were tested on UL's small-scale horizontal furnace with temperatures controlled in accordance with the standard time temperature curve published in UL 263. Tests were conducted to determine the time at which the temperature on the unexposed surface was raised an average of 250 °F over the surface or 325°F at an individual location.

Test data was analyzed to develop equations for predicting the time at which assemblies would reach an average of 250 °F over the surface or 325 °F at an individual location for a thickness of material over the various substrates. From these equations, the following tables have been developed.

Thickness when applied over expanded metal lath					
	Minimum Thickness (inches)				
Density	1 Hr.	1 1/2 Hr.	2 Hr.	3 Hr.	4 Hr.
MK-6HY*	1 1/2	2 1/16	2 5/8	3 3/4	4 7/8
Z-106/HY**	1 1/2	2 1/16	2 5/8	3 3/4	4 7/8
Z-146***	1 1/2	1 15/16	2 5/8	3 1/4	4 5/16

Thickness when applied over min. 26 MSG					
	Minimum Thickness (inches)				
Density	1 Hr.	1 1/2 Hr.	2 Hr.	3 Hr.	4 Hr.
MK-6HY*	1 1/2	2 1/16	2 5/8	3 1/16	4 7/16
Z-106/HY**	1 1/2	2 1/16	2 5/8	3 1/16	4 7/16
Z-146***	1 1/2	1 15/16	2 3/8	3 1/16	4 5/16

Thickness when applied over steel plate 0.25 inch or greater					
	Minimum Thickness (inches)				
Density	1 Hr.	1 1/2 Hr.	2 Hr.	3 Hr.	4 Hr.
MK-6HY*	1 1/8	1 5/8	2 1/16	2 11/16	3 3/8
Z-106/HY**	1 1/16	1 7/16	1 13/16	2 9/16	3 5/16
Z-146***	1 1/8	1 1/2	1 7/8	2 5/8	3 15/16

* Also includes MK-6s, MK-6/HY Extended Set, MK-10/HB, MK-10/HB Extended Set, MK-1000/HB, MK-1000/HB Extended Set, MK-6 GF, MK-6 GF Extended Set, RG, and Z106G

** Also includes Z-106

*** Also includes Z-146, Z-146T, Z-146PC, and Z-156, Z-156T, Z-156PC

We have completed our investigation and determined that when exposed to the standard time temperature curve from UL 263, the thicknesses of UL Classified SFRM materials applied to lath, and over the substrates described above, have demonstrated the ability to limit the unexposed surface temperatures to an average temperature rise of not more than 250 °F or not more than 325 °F at an individual location.

In no event shall UL LLC. be responsible to anyone for whatever use or non-use is made of the information contained in this letter and in no event shall UL LLC., its employees, or its agents incur any obligation or liability for damages, including, but not limited to

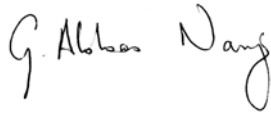
consequential damages, arising out of or in connection with the use, or inability to use, the information contained in this letter.

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Only those products bearing the appropriate Classification Marking and the company's name, trade name, trademark, or other recognized identification should be considered as covered by UL's Classification and Follow-Up Service. Any information and documentation involving UL Mark services are provided on behalf of UL LLC or any authorized licensee.

We trust that the above satisfies your request. However if you should have any additional questions, please contact the undersigned.

Sincerely,



G. Abbas Nanji.
Sr. Staff Engineer
Fire Resistance Group
Building Materials Section
Tel: 416 288 2208

Reviewed by:



Ahmad F. Mangou. M.Sc., P Eng.
Staff Engineer
Fire Resistance Group
Building Materials Section
Tel: 416 288 2275

SECTION 078123 - INTUMESCENT FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mastic and intumescent fire-resistive coatings.
- B. Related Requirements:
 - 1. Section 078100 "Applied Fire Protection" for sprayed fire-resistive materials.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Mastic and intumescent fire-resistive coatings.
 - 2. Substrate primers.
 - 3. Reinforcing fabric.
 - 4. Reinforcing mesh.
 - 5. Topcoat.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
 - 1. Extent of fire protection for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum mastic and intumescent fire-resistive coating thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of mastic and intumescent fire-resistive coating after application.
- C. Samples: For each exposed product and for each color and texture specified, 4 inches (102 mm) square in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of mastic and intumescent fire-resistive coating.
- C. Evaluation Reports: For mastic and intumescent fire-resistive coating, from ICC-ES.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by mastic and intumescent fire-resistive coating manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of each type of fire protection and different substrate and each required finish as shown 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.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 50 deg F (10 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fire protection from single source.
- C. Fire-Resistance Design: Tested in accordance with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
 - 2. Required rating: 60 minutes (1 hour)
- D. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation, and complying with indicated fire-resistance design.

1. **Basis-of-Design Product:**
 - a. Interior: Subject to compliance with requirements, provide Isolatek International; Cafco SprayFilm-WB 3 or a comparable product by one of the following:
 - 1) Hilti, Inc.
 - 2) International Protective Coatings.
 - 3) **Carboline Global: AD Firefilm III**
 - b. Exterior: Subject to compliance with requirements, provide Isolatek International; Cafco SprayFilm-WB 4 or a comparable product by one of the following:
 - 1) Hilti, Inc.
 - 2) International Protective Coatings.
 - 3) **Carboline Global: Thermolag E100S**
2. Application: Designated for "exterior", "interior general purpose" or "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design.
4. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
5. Hardness: Not less than 65, Type D durometer, in accordance with ASTM D2240.
6. Finish: Spray-textured finish.

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that are compatible with mastic and intumescent fire-resistive coating and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by mastic and intumescent fire-resistive coating manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Topcoat: Suitable for application over mastic and intumescent fire-resistive coating; of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer for each fire-resistance design. Products listed below are for basis-of-design Isolatek WB 3 and WB 4
 1. Interior: Top Quality acrylic latex
 2. Exterior: Sherwin Williams Steel Master 9500
 - a. For exterior applications with CAFCO® SprayFilm® WB 4 (ISOLATEK® Type WB4) , CAFCO SprayFilm Topseal™ (ISOLATEK Type Topseal) must be applied over the CAFCO SprayFilm WB 4 per the specified UL design listings.
 - b. For exterior applications, exterior finish coat materials are required over SprayFilm Topseal for color-coding, aesthetics, and additional surface protection and shall be approved by the thin-film fire resistive manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.
 - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
 - 2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.
- B. Conduct tests in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.
- B. Clean substrates of substances that could impair bond of fire protection.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by mastic and intumescent fire-resistive coating manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fire protection Work.

- B. Comply with mastic and intumescent fire-resistive coating manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
 - 1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
- D. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and mastic and intumescent fire-resistive coating manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- E. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- F. Extend fire protection in full thickness over entire area of each substrate to be protected.
- G. Install body of fire protection in a single course unless otherwise recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.
- I. Cure fire protection in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes: Where indicated, apply fire protection to produce the following finishes:
 - 1. Spray-Textured Finish: Finish left as spray applied with no further treatment.
- L. Topcoats: Apply topcoats in accordance with manufacturer's instructions.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC, Subsection 1705.14, "Mastic and Intumescent Fire-Resistant Coatings."
- B. Fire protection will be considered defective if it does not pass tests and inspections.

1. Remove and replace fire protection that does not pass tests and inspections, and retest.
2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

C. Prepare test and inspection reports.

3.5 CLEANING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

- A. Protect fire protection, in accordance with advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.7 REPAIRS

- A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.
- B. Repair fire protection damaged by other work before concealing it with other construction.
- C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Penetration firestopping systems.
- B. Related Requirements:
 - 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration 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 Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.7 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 ventilations or, where this is inadequate, forced-air circulation.

1.8 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.
 - 1. Manufacturer to be the same as used for Section 078443 "Joint Firestopping"

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.

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. 3M Building and Construction.
 - b. Hilti, Inc.
 - c. Specified Technologies, Inc.
 - 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 (200-mm) 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. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined in accordance with UL 1479.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
 - E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, in accordance with ASTM E84.
 - F. 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 (13 mm) 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 (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- 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 (150 mm) 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 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration 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 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 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joints in or between fire-resistance-rated construction.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.
- B. Related Requirements:
 - 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
 - 2. Section 079513.13 "Interior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
 - 3. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
 - 4. Section 092216 "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 curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.
- 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.
 - 1. Manufacturer to be the same as used for Section 078413 "Penetration Firestopping"

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. (0.00115 cu. m/s x m) in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 in accordance with ASTM E90 or ASTM C919.
- C. For aluminum curtain-wall assemblies with one- or two-piece rectangular mullions at least 2-1/2 by 5 inches (64 by 127 mm), provide perimeter fire-barrier system that does not require direct screw attachment to mullions and transoms to support and fasten curtain-wall insulation. System to be tested in accordance with ASTM E2307 for up to 2-hour fire resistance and with ASTM E1233 for wind cycling equivalent to 108 mph (174 km/h) wind for 500 cycles.
- D. 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. 3M Building and Construction.
 - 2. Hilti, Inc.
 - 3. Specified Technologies, Inc.
- E. 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.
- F. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.
 - 1. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

- G. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 - 1. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- H. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

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 (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 ft. (4.57 m) from end of wall and at intervals not exceeding 30 ft. (9.14 m).
- B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) 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. Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.
- B. 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.
- C. 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 078443

SECTION 079200-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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Urethane joint sealants.
 - 2. Latex joint sealants.
 - 3. Silicone Window sealants.
 - 4. Solvent-release-curing joint sealants.
- B. Related Sections:
 - 1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
 - 2. Division 07 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
 - 3. Division 08 Section "Glazing" for glazing sealants.
 - 4. Division 09 Section "Gypsum Board" for sealing perimeter joints.
 - 5. Division 32 Section "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- 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. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. 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. Qualification Data: For qualified Installer.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Field-Adhesion Test Reports: For each sealant application tested.
- G. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- D. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT 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 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not

comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. 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.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
 4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- E. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 URETHANE JOINT SEALANTS

- A. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for 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 - Dynatrol I.
 - b. Tremco - Dymonic.
 - c. Sika - SikaFlex 1A.
 - d. BASF Building Systems; Sonneborn - NP 1.
- B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use T.
 - 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 - NR-201 Urexpan.
 - b. Tremco - Tremflex SL.
 - c. BASF Building Systems; Sonneborn - SL 1.
- C. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for 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 - Dynatrol II.
 - b. Tremco - Dymeric 240.
 - c. Sika - 2c NS/SL.
 - d. BASF Building Systems; Sonneborn - NP 2.

2.3 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: 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. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20+.
 - d. Tremco Incorporated; Tremflex 834.

2.4 SILICONE JOINT SEALANTS

- A. Silicone Window Sealant: One part neutral cure silicone Sealant: ASTM C 920 Type S, Grade NS, Class 25, for Use G, A, O
 - 1. Basis of Design: Subject to compliance with requirements, provide products by:
 - a. Dow; Dowsil 758 Silicone Weather Barrier Sealant

2.5 PREFORMED JOINT SEALANTS

- A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in

precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

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. Dayton Superior Specialty Chemicals; Polytite Standard.
 - b. EMSEAL Joint Systems, Ltd.; Emseal 25V.
 - c. Willseal USA, LLC; Willseal 150.

2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are 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.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 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 joint-sealant performance.
- 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.
 - c. Cast Stone.
 - d. Unglazed surfaces of ceramic tile.
 - 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. Metal.
 - b. Glass.
 - c. Glazed surfaces of ceramic tile.
- 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:
 - 1. Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
 - 2. Install and inspect sealants in accordance with NIBS Guideline 3-2006: Annex M.2 example Construction Checklist for Building Envelope System Joint Sealants (or more recent version) and NIBS Guideline 3-2006: Annex M.1 Construction & Industry Checklist M.1-5 for Joint Sealers (or more recent version).

- 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 bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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.
- F. Tooling of Non-sag Sealants: At locations other than weather proofing areas, tooling agents not allowed in weatherproofing sealants.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, 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 C 919 and with manufacturer's written recommendations.

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 and remove 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: Exterior joints in horizontal traffic surfaces.
 - 1. Urethane Joint Sealant: Single component, nonsag, traffic grade, Class 25.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Urethane Joint Sealant: Multicomponent, nonsag, Class 50.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Exterior weather proofing joints in vertical surfaces and horizontal nontraffic surfaces, where not painted and compatible with substrate.
 - 1. Silicone Joint Sealant: Single component, nonsag, Class 50.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Urethane Joint Sealant: Single component, nonsag, traffic grade, Class 25.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Acrylic-Latex Joint Sealant: Single component, nonsag, Type OP, Grade NF.
 - 2. 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 Sealant: Mildew resistant, single component, nonsag, urethane.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant: Acoustical.
 - 2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- H. Joint-Sealant Application: Exterior joints between window and door flanges and self adhered flashing.
 - 1. Silicone Joint Sealant: One part neutral cure, Type S, Grade NS, Class 25, for Use G, A, O
 - 2. Joint-Sealant Color: White

END OF SECTION 079200

SECTION 079513.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior expansion joint covers.
- B. Related Requirements:
 - 1. Section 077129 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion joint cover assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.
 - 1. 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 (150 mm) long in size.
- D. Samples for Initial Selection: For each type of exposed finish.
 - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.
- E. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches (150 mm) long in size.
- F. 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.

1.3 MOCKUPS

- A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of typical expansion joint cover assembly as shown 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.

PART 2 - PRODUCTS

2.1 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.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Expansion Joint Design Criteria:
 1. Seismic Movement:
 - a. Joint Movement: As indicated on Drawings.

2.3 EXTERIOR EXPANSION JOINT COVERS

- A. Exterior Elastomeric-Seal Joint Cover (Base): 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 inpro Corporation; 615-A07-150 or a comparable product by one of the following:
 - a. Balco; a CSW Industrials Company.
 - b. Construction Specialties, Inc.
 - c. **MM Specialties: VSS 600-E**
 2. Application: Wall to wall.
 3. Installation: Recessed.
 4. Exposed Metal:
 - a. Aluminum: Manufacturer's standard.
 5. Integral flexible moisture barrier membrane
 - a. 2 ply reinforced EPDM, 45 mil.
 6. Seal: Pleated Santoprene
 - a. Color:
 - 1) At CMU: Grey
 - 2) At Insulated Metal Panels: Beige
- B. Preformed Foam Joint Seals (Alternate): Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Basis of Design Manufacturer: Inpro Corporation Model 1100 Closed Cell Epoxy Foam below grade to 1' above grade, Model 1200 above grade to roof
 - a. Other acceptable manufacturer's include but are not limited to:
 - 1) CS Construction Specialties
 - 2) Substitutions – See Section Substitution procedures
2. Design Criteria:
 - a. Nominal Joint Width: As indicated on Drawings.
3. Joint Seal Color: Custom matching adjacent exterior surfaces.

2.4 MATERIALS

- A. Aluminum: ASTM B221 (ASTM B221M), Alloy 6063-T5 for extrusions; ASTM B209 (ASTM B209M), 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. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.5 ALUMINUM FINISHES

- A. Mill finish.

2.6 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
 1. Provide at below grade locations
- B. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

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 (75 mm) from each end and not more than 24 inches (600 mm) 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.

3.4 CONNECTIONS

- A. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with roof expansion joint covers specified in Section 077129 "Manufactured Roof Expansion Joints." Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joint cover assemblies.

3.5 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 079513.16

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 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.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data:
 - 1. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Product Data Submittals: For each product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- C. 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 electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

- D. Product Schedule: For hollow-metal doors and frames, 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 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
- B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Provide a label for each fire rated and sound rated door indicating the testing agency's approval for the required rating. Do not cover or obscure the label in any way.
- C. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
 1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
 - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.34, R-Value 2.9, including insulated door, thermal-break frame and threshold.
 2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
 - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

- D. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
- E. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames 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 doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
 - 1. Approved Steel Doors and Frames:
 - a. Ceco Door, an Assa Abloy Group Company: www.assaabloydss.com.
 - b. Curries, an Assa Abloy Group Company: www.assaabloydss.com.
 - c. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - d. Steelcraft, an Allegion brand: www.allegion.com/sle.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
- B. Fire-Rated, Borrowed-Lite Assemblies: 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 in accordance with NFPA 257 or UL 9.
- C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.34 when tested in accordance with ASTM C1363 or ASTM E1423.

1. Air filtration: rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B..
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Core: Manufacturer's standard.
 - g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated doors.
 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
 3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B..
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm), with minimum A60 (ZF180) coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: Vertical steel stiffener with fiberglass batts.
 - i. Wind resistant building components tested to the following windstorm or severe weather performance standards:
 - 1) ANSI A250.13

- 2) ASTM E330/E1886/E1996
- j. Construction: Doors over 3'-0" in width that have an exit device must have a horizontal steel stiffener located at centerline of device. When door height is over 7'-0" and design pressure is over 60 PSF and door has mortise lock (single door) or has an ANSI strike with bolts on inactive leaf of pair, vertical lock edge steel stiffeners must be installed.
- k. Door Thermal Resistance: Min. R-value of 10.
- l. Weatherstripping: Integral, recessed into door edge or frame.
- 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
 - b. Construction: Full profile welded.
- 3. Exposed Finish: Prime.
- 4. Wind resistant building components tested to the following windstorm or severe weather performance standards:
 - a. ANSI A250.13
 - b. ASTM E330/E1886/E1996
 - c. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
 - d. Weatherstripping: Integral, recessed into frame edge.

2.5 BORROWED LITES

- A. Fabricate of uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
- B. Construction: Full profile welded.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
 - 3. Postinstalled Expansion Anchor: ~~Minimum 3/8 inch (9.5 mm) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer. Not Permitted~~
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) 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 in accordance with ASTM A153/A153M, Class B.

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. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- E. 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.
- F. 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 E136 for combustion characteristics.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

- A. Door 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 (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 1. Sidelite 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 welding, or by rigid mechanical anchors.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. 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.

- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

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 ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.
 2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
 3. Floor Anchors: Secure with post installed expansion anchors.
 4. Solidly pack mineral-fiber insulation inside frames.
 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

- A. 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.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid-core seven-ply flush wood veneer-faced doors and transom panels for transparent finish.
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass view panels in flush wood doors.
 - 2. Section 087100 "Door Hardware"

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Solid-core seven-ply flush wood veneer-faced doors and transom panels for transparent finish.
- B. Product Data Submittals: For each product, including the following:
 - 1. Door core materials and construction.
 - 2. Door edge construction
 - 3. Door face type and characteristics.
 - 4. Factory-machining criteria.
 - 5. Factory- finishing specifications.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
 - 1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
 - 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 - 3. Details of frame for each frame type, including dimensions and profile.
 - 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 5. Dimensions and locations of blocking for hardware attachment.
 - 6. Dimensions and locations of mortises and holes for hardware.
 - 7. Clearances and undercuts.
 - 8. Requirements for veneer matching.
 - 9. Doors to be factory finished and application requirements.
- D. Samples for Initial Selection: For factory-finished doors.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Special warranties.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
- B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. 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 and relative humidity at levels designed for building occupants for the remainder of construction period.

1.9 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. Delamination of veneer.

- b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
- c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
- 2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
- 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

2.2 SOLID-CORE SEVEN-PLY FLUSH WOOD VENEER-FACED DOORS AND TRANSOM PANELS FOR TRANSPARENT FINISH

- A. Interior Doors, Seven-Ply Veneer-Faced:
 - 1. Manufacturers:
 - a. Algoma: www.algomahardwoods.com.
 - b. Graham Wood Doors: www.grahamdoors.com.
 - c. Marshfield Door Systems, Inc: www.marshfielddoors.com.
 - d. VT Industries, Inc: www.vtindustries.com/#sle.
 - e. Or Approved Equal
 - f. Substitutions: See Section 016310 – Substitutions.
 - 2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
 - 3. Retain "ANSI/WDMA I.S. 1A Quality Grade" or "Architectural Woodwork Standards Quality Grade" Subparagraph below.
 - 4. Architectural Woodwork Standards Quality Grade: Custom.
 - 5. Faces: two-ply wood panel with wood veneer not less than 1/50 inch (0.508 mm) thick.
 - a. Species: Select white maple.
 - b. Cut: Plain sliced (flat sliced).
 - c. Match between Veneer Leaves: Book match.
 - d. Assembly of Veneer Leaves on Door Faces: Running match.
 - e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 - f. Transom Match: End match.
 - 6. Exposed Vertical and Top Edges: Same species as faces - Architectural Woodwork Standards edge Type A.
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors:
 - 1) Provide formed-steel edges and astragals with intumescent seals.
 - a) Finish steel edges and astragals with baked enamel same color as doors.

- c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: 475 lbf (2110 N) in accordance with WDMA T.M. 10.
- 7. Core for non-fire-rated doors, WDMA I.S. 10 structural composite lumber.
- 8. Core for fire-rated doors, as required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as follows:
 - 1) 6-inch (125-mm) top-rail blocking.
 - 2) 6-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
 - 3) 6-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
 - 4) 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
- 9. Construction: Seven plies, hot-pressed or cold-pressed, bonded or unbonded.

2.3 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.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 - 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 - 1. Locate hardware to comply with DHI-WDHS-3.
 - 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 - 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 - 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 - 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

2.5 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
 - 3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: Custom.
 - a. System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane. Or
 - 2. ANSI/WDMA I.S. 1A Grade: Custom.
 - a. TR-8 UV Cured Acrylated Polyester/Urethane.
 - 3. Staining: As selected by Architect from manufacturer's full range.
 - 4. Sheen: Satin.

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 087100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 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 081416

SECTION 081613 - FIBERGLASS DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass doors.

1.2 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing.

1.3 REFERENCE STANDARDS

- A. AAMA 1304 - Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems; 2018.
- B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- C. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
- D. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).
- E. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
- F. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.
- G. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- J. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

- K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- L. 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).
- M. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2019c.
- N. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- P. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.5 SUBMITTALS

- A. See Section - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.
- C. Shop Drawings: Indicate layout and profiles; include assembly methods.
 - 1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
 - 2. Indicate wall conditions, door and frame elevations, sections, materials, gauges, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.
- D. Door Corner Sample: Submit corner cross sections, 10 inches by 10 inches in size, illustrating construction, finish, color, and texture.
- E. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Data: Include instructions for repair of minor scratches and damage.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer; include detailed terms of warranty.

- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016310 - Substitutions, for additional provisions.
 - 2. Package products with protective coverings and identify with descriptive labels.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Mark doors with location of installation, door type, color, and weight.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
 - 1. Store at temperature and humidity conditions recommended by manufacturer.
 - 2. Do not use non-vented plastic or canvas shelters.
 - 3. Immediately remove wet wrappers.
- D. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inch space between doors.

1.8 FIELD CONDITIONS

- A. Do not install doors until structure is enclosed.
- B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.9 WARRANTY

- A. See Section - Warranties and Bonds, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty covering materials and workmanship, including degradation or failure due to chemical contact.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
 - 1. Approved Manufacturer:

- a. Tiger Door, LLC: www.tigerdoor.com.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by listed manufacturers. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
- C. Laminated Fiberglass Doors:
 - 1. Ceco Door Products: www.cecodoor.com/#sle.
 - 2. Corrim Company: www.corrim.com/#sle.
- D. Pultruded Fiberglass Reinforced Plastic (FRP) Doors:

2.2 MECHANICAL PROPERTIES AND TEST PERFORMANCE

- A. Pultruded structural shapes for edges, frames, and astragals shall exhibit the following minimum longitudinal coupon properties (per ASTM):
 - 1. Tensile strength (D638) 30,000 psi
 - 2. Comprehensive strength (D695) 30,000 psi
 - 3. Flexural strength (D790) 30,000 psi
 - 4. Flexural modulus (D790) 1,600,000 psi
 - 5. Shear strength (D2846) 4,500 psi
 - 6. Impact, notched (D256) 25 ft-lb/in
 - 7. Barcol hardness (D2853) 50
- B. Core material shall exhibit the following minimum properties:
 - 1. Core material must comply with the International Building Code (IBC) chapter 26 requirements for use with a plastic skin.
 - 2. Core material must be asbestos free incombustible mineral composition.
- C. Core banding material shall exhibit the following minimum coupon properties (per ASTM):
 - 1. Core banding material must comply with the International Building Code (IBC) chapter 26 Requirements for use with a plastic skin.
 - 2. Modulus of Rupture (C133) 1700 psi
 - 3. Compressive Strength (C109-93) 2800 psi
 - 4. Thermal Conductivity 946 F (C182) 1.38 (BTU-in/hr-ft²-F)
 - 5. Thermal Conductivity 1632 F (C182) 1.39 (BTU-in/hr-ft²-F)
 - 6. Shrinkage average % (C356) at 1200 F 24 hours -4.7%
 - 7. Screw Holding 1100 lbs
 - 8. Electrical Resistivity from ambient to 1148 F (D257) 3.40 E+10 ohm-cm
 - 9. Heat Transfer for unexposed surface rise above ambient 90 minute, 1772 F (E 152) 196 F
 - 10. Density minimum 60 lb/ft³
 - 11. Core banding material must be asbestos free incombustible mineral composition.
- D. Adhesive for bonding pultrusions shall exhibit the following minimum coupon properties (per SAE)
 - 1. Tensile Strength (D882-83A modified) minimum 2000 psi
 - 2. 8 day 25° C at 100% humidity Cross Peel (SAE J1553) minimum 330 psi
 - 3. 7 day immersion in seawater Cross Peel (SAE J1553) minimum 330 psi
 - 4. 30 day immersion in saltwater Cross Peel (SAE J1553) minimum 330 psi

5. 72 hour immersion in gasoline Cross Peel (SAE J1553) minimum 330 psi
6. 72 hour immersion in 20% sulfuric acid Cross Peel (SAE J1553) minimum 300 psi
7. UL 10b, UL 10c / UBC7-2 positive pressure - Doors and Frames
 - a. Singles and pairs, with component listings for both FRP doors and FRP frames.

2.3 COMPONENTS

A. Fire Rated FRP Doors:

1. Design: FRP doors shall be of seamless press-molded construction. Laminated FRP face sheets shall be applied while wet and uncured to an internal door stile and rail subframe/core assembly and then press-molded under heat and pressure. The composite door panel must be integrally fused over its entire surface area, not just adhesive-bonded at perimeter stiles and rails. Doors shall remain under pressure during curing for flat, warp-free surfaces.
2. Core: For maximum rigidity and compressive strength a fire resistant mineral core shall be used. Molding pressure and resin gel time shall be sufficient to allow for penetration of resin into the cellular structure of the core to maximize shear and peel strengths at the skin/core interface and reduce the possibility of delamination. The mineral core is to be completely enclosed within the intumescent and FRP laminated edge perimeter.
3. Intumescent: Only Category A type door construction is permitted. All intumescents shall be molded into the door structure with a minimum of 1/8" thick perimeter FRP edge banding (prior to machining). Category B type door construction, with post applied and/or exposed edge intumescent components or products are not acceptable.
4. Faces: Door facings shall be 0.120" composite FRP sheet exterior grade, fiber reinforced plastic panel on interior and exterior faces. Colored pigment shall be maximum amount formulated with the resin. FRP face sheets shall be USDA acceptable, non-porous, with a maximum flame spread rating of 200, and smoke generated maximum of 450 degrees meeting Class C requirements per ASTM E84.
5. Finish: The exposed FRP door faces shall have a 3-4 mils (wet) factory applied two-part aliphatic polyurethane fully cured coating of industrial urethane. Coating shall have a minimum hardness of H to 2H. Finish shall be a slightly textured semi-gloss to minimize the visual effects of wear and tear.
 - a. Gel Coating Thickness: Minimum 15 mils wet, plus/minus 3 mils.
 - b. Gel Coating Color: As selected by Architect from Manufacturer's full range.
6. Astragals: Provide a heavy pultruded FRP angle astragal on the meeting stile edge of each inactive leaf of double door pairs.
7. Lights: Provision for door lights shall be performed during manufacture and shall not be attempted in the field. Cutouts are to be totally enclosed by internal high density fire resistant mineral core composite blocks incorporated into door subframe prior to press-molding and machining, the opening is completely fused to both door skins. Vision frames shall be a commercially available UL fire rated kit. Maximum glass size shall not exceed 1296 in² for up to a 90 minute application.
8. Size limitations: The maximum double door jamb opening size shall not exceed nominal 8' - 0" x 8' - 0" with a Maximum single door panel size not to exceed nominal 4' - 0" x 8' - 0".

B. Doors: Fiberglass construction with reinforced core.

1. Thickness: 1-3/4 inch, nominal.
2. Core Material: Manufacturer's standard core material for application indicated.
3. Construction:

- a. Pultruded as single monolithic fiberglass reinforced plastic (FRP) panel.
 - b. Molded in one piece including through color gel coating on each side; manufacturer's standard subframe, core and faces fused during curing; hardware reinforcements.
 - c. Fiberglass faces laminated to core with an applied gel coating, or molded in one piece including gel coating on each side.
 - d. Fiberglass ultraviolet resistant mylar coated, with 1/8 inch thick through color face sheets laminated to core.
 - e. Fiberglass face sheets, 1/8 inch thick, laminated to core; factory primed for field painting to match framing.
4. Face Sheet Texture: Smooth.
 5. Door Panel: As indicated on drawings.
 6. Subframe and Reinforcements: Manufacturer's standard materials.
 7. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.
 8. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.
 9. Bottom Rail: Provide height necessary to allow up to 1-1/4 inch field cut off at bottom of door without impairing door strength or durability.

C. Hollow Metal Frames: See Section 081113 - Hollow Metal Doors and Frames.

2.4 PERFORMANCE REQUIREMENTS

- A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.
- B. Forced Entry Resistance: Pass in accordance with AAMA 1304 test method.
- C. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 7.5 psf.
- D. Air Leakage: Maximum of 0.1 cfm per square foot at 6.27 psf differential pressure, when tested in accordance with ASTM E283.
- E. Structural Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
- F. Thermal Transmittance, Exterior Doors: AAMA 1503, U-value of 0.35, maximum, measured on exterior door in size required for this project.
- G. Acoustical Performance: Sound Transmission Class (STC) of 50, minimum, when tested in accordance with ASTM E90.
- H. Fiberglass Reinforced Plastic (FRP) Face Sheet Properties:

1. Izod Impact Resistance: ASTM D256, 7 foot-pound force per inch of width, minimum, with notched izod.
2. Tensile Strength at Break: ASTM D638, 13,250 psi, minimum.
3. Water Absorption: ASTM D570, 0.16 percent, maximum, after 24 hours at 74 degrees F.
4. Flexural Strength: ASTM D790, 27,000 psi, minimum.
5. Barcol Hardness: ASTM D2583, minimum of 40 units.

2.5 FINISHES

- A. Gel Coating: Ultraviolet (UV) stabilized polyester finish.
 1. Thickness: Minimum 15 mils, 0.015 inch wet thickness, plus/minus 3 mils, 0.003 inch.
 2. Color: As selected by Architect from Manufacturer's full range.
- B. Painted: Two-part aliphatic polyurethane, low VOC industrial coating.
 1. Thickness: Minimum 5 mils, 0.005 inch wet thickness.
 2. Color: As selected by Architect from Manufacturer's full range.

2.6 ACCESSORIES

- A. Stops for Glazing: Fiberglass, unless otherwise indicated or required by fire rating; provided by door manufacturer to fit factory made openings, with color and texture to match door; fasteners shall maintain waterproof integrity.
 1. Exterior Doors: Provide non-removable stops on exterior side with continuous compression gasket weatherseal.
 2. Glazed Openings: Provide removable stops on interior side.
 3. Fire-Rated Doors: Provide stop kit listed by labeling authority.
 4. Opening Sizes and Shapes: As indicated on drawings.
- B. Glazing: See Section 088000.
- C. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 1. Size: As indicated on drawings.
 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
 3. Metal Finish: Beige polyester powder coating.
 4. Glazing: See Section 088000.
- D. Door Hardware: See Section 087100.
- E. Doors shall be factory mortised and drilled for mortise template butt hinges, with #12x2" long stainless steel screws pre-installed for hinge attachment. Provide 161 cylindrical lock bore, rim deadbolt, ANSI 86 mortise lock edge prep and pocket or flush bolt cutouts as required.
- F. Frames shall be factory machined and drilled for all hardware requiring mortises, with #12x1" long stainless steel screws pre-installed for hinge attachment.
- G. Hardware shall be furnished as listed in section 08 70 00 or as so designated in appropriate section, and shall be coordinated by GC and installed by experienced mechanics.
- H. Supplier shall furnish manufacturer's standard templates, installation instructions, or full size approved door and frame preparation instructions as approved by the architect and as required

by door and frame manufacturer prior to door and frame factory initiated manufacture. Standard factory lead-time for production of FRP doors and frames shall commence only and when all distributor required preparation information is received and acknowledged by the door and frame manufacturer.

- I. All fasteners for all hardware shall be type 304 CRSS (18-8 series corrosion resistant stainless steel). No carbon steel or aluminum components shall be used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Clean and prepare substrate in accordance with manufacturer's directions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.
- B. Install fire-rated assemblies in accordance with NFPA 80.
- C. Install exterior doors in accordance with ASTM E2112.
- D. Install door hardware as specified in Section 087100.
- E. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.
- F. Set thresholds in continuous bed of sealant.
- G. Frames: Install in strict accordance with manufacturer's printed instructions. Set plumb and square, using shims for bolt-in of existing openings, or wood bracing.
- H. Doors: Hang per manufacturer's printed instructions using special screws provided for hinge attachment. Install doors to swing freely and to stand open at any angle. After installation make final adjustments to hardware to allow for proper door operation and latching. All surface applied hardware shall be thru bolted.

- I. In masonry walls, install frames prior to laying masonry; anchor frames into masonry mortar joints.
- J. In stud walls, install frames prior to building walls; anchor frames to studs using concealed anchors.
- K. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.
- L. Repair or replace damaged installed products.

3.4 ADJUSTING

- A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.
- B. Adjust hardware for smooth and quiet operation.
- C. Adjust doors to fit snugly and close without sticking or binding.

3.5 CLEANING

- A. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

3.6 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 081613

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for roof hatches.
2. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.
- C. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

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. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.

- d. [Karp Associates, Inc.](#)
 - e. [Larsens Manufacturing Company.](#)
 - f. [MIFAB, Inc.](#)
 - g. [Milcor; Commercial Products Group of Hart & Cooley, Inc.](#)
- 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage, factory primed.
 - 5. Frame Material: Same material, thickness, and finish as door.
 - 6. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- E. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.
- F. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- G. Frame Anchors: Same material as door face.
- H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 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 mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

2.4 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.

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.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Insulated service doors.
 - 2. Fire-rated service doors.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. Include description of automatic-closing device and testing and resetting instructions.
- 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. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - 5. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
 - 6. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing and inspecting agency.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.
- C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Special warranty.
- B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.
- C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

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. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAl) certification.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: At exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control: In corridors and smoke barriers, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency

for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m) of door opening at 0.10 inch wg (24.9 Pa) for both ambient and elevated temperature tests.

- B. Accessibility Standard: Comply with applicable provisions in ICC A117.1.
- C. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: According to ASTM E330/E330M.
 - 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 - 4. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- D. Seismic Performance: Overhead coiling doors are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.0.

2.3 DOOR ASSEMBLY: WB01

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; 625 Stormtite or a comparable product by one of the following:
 - a. C.H.I. Overhead Doors, Inc.
 - b. Cookson; a CornellCookson company.
 - c. Cornell; a CornellCookson company.
- B. Performance:
 - 1. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
 - 2. Air Infiltration: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft².
- C. Operation Cycles: Door components and operators capable of operating for not less than 20,000. 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.
- D. Wall Mounting Condition:
 - 1. Face-of-wall mounting
- E. Insulated Door Curtain
 - 1. R-Value: 7.7
 - 2. U-Factor: 0.13

- F. Door Curtain Material: 24 Ga Galvanized steel.
- G. Door Curtain Slats: Flat profile slats of 2-5/8-inch (67-mm) center-to-center height.
 - 1. Insulated-Slat Interior Facing: Metal.
- H. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from hot-dip galvanized steel and finished to match door.
- I. Curtain Jamb Guides: Three structural steel angles
- J. Brackets
 - 1. Galvanized steel to support counterbalance, curtain and hood.
- K. Hood:
 - 1. Provide with internal hood baffle weatherseal.
 - 2. 24 gauge galvanized steel with intermediate supports as required.
- L. Locking Devices: Equip door with chain lock keeper.
- M. Weatherseals:
 - 1. Vinyl bottom seal, exterior guide and internal hood seals.
 - 2. Interior guide weather seal
 - 3. Lintel weatherseal
 - 4. Air Infiltration Package, IECC 2012/2015 listed; product to meet C402.4.3 2012 Air leakage <1.00 cfm/ft².
 - a. Air infiltration perimeter seal package includes: guide cover, guide cap, dual brush exterior guide seal, 4 inch finned lintel brush seal and vinyl bottom seal.
- N. Locking:
 - 1. All: Chain keeper locks for chain hoist operation.
 - 2. WB01: Cylinder lock
- O. Manual Door Operator: Chain-hoist operator.
- P. Finishes
 - 1. Slats and Hood Finish:
 - a. Polyester Top Coat.
 - 1) Gray polyester.
 - b. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
 - 2. Bottom Bar, Guides, Headplate and Brackets:
 - a. PowderGuard Premium powder coat color as selected by the Architect.

2.4 FIRE-RATED DOOR ASSEMBLY

- A. Fire-Rated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; FireKing 631 or a comparable product by one of the following:
 - a. C.H.I. Overhead Doors, Inc.
 - b. Cookson; a CornellCookson company.
 - c. Cornell; a CornellCookson company.
 - d. McKeon Door Company.
 - B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. 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.
 - C. Fire Rating: 3 hours.
 - D. Wall Mounting Condition:
 1. Face-of-wall mounting
 - E. Door Curtain Material: Galvanized steel.
 - F. Door Curtain Slats: Flat profile slats of 2-5/8-inch (67-mm) center-to-center height.
 - G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from hot-dip galvanized steel and finished.
 - H. Curtain Jamb Guides: Galvanized steel
 - A. Hood:
 1. 24 gauge galvanized steel with intermediate supports as required.
 - B. Manual Door Operator: Chain-hoist operator.
 - C. Curtain Accessories: Equip door with smoke seals, automatic-closing device,.
 - D. Finish:
 1. Galvanized Steel: Slats and hood galvanized steel to ASTM A 653 finished with a rust-inhibitive roll coating process, including bonderizing, a 0.2 mils thick baked prime paint, and a 0.6 mils thick baked top coat.
 - a. Polyester Top Coat.
 - b. Gray polyester.
 2. Non-galvanized exposed ferrous surfaces shall be black powder coated.
- 2.5 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.

2.6 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm); and as required.
 - 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
 - 3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 0.028 inch (0.71 mm).
- B. 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, and a continuous bar for holding windlocks.

2.7 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. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized-steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M.
 - 2. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

2.8 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: 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: As specified in Section 087100 "Door Hardware" and keyed to building keying system.
- C. Chain Lock Keeper: Suitable for padlock.

2.9 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.
- C. Automatic-Closing Device: Equip each fire-rated door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Testing for manually operated doors allows resetting by opening the door without retensioning the counterbalance mechanism. Automatic-closing device is to be designed for activation by the following:
 - 1. Replaceable fusible links with temperature rise and melting point of 165 deg F (74 deg C) interconnected and mounted on both sides of door opening.

2.10 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic-closing device operates.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.11 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.

- B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf (111-N) force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

2.12 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 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.

2.13 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

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, GENERAL

- A. Install overhead coiling 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 overhead coiling 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 the accessibility standard.
- D. Fire-Rated Doors: Install according to NFPA 80.
- E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

- F. Power-Operated Doors: Install according to UL 325.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
 - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service includes 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 proper door operation.

Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 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 083323

SECTION 083483 - FIRE & SMOKE DOOR CONTAINMENT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Smoke detector activated Fire & Smoke door smoke containment curtain and control system designed seal the doorway opening.
- B. Products Supplied But Not Installed Under This Section:
 - 1. End-of-line diode (3.9V, 2W). Installed at smoke detector to monitor the circuit.
- C. Related Sections:
 - 1. 09 2216–Non-Load Bearing Wall Framing: Metal backing in housing mounting area.
 - 2. 09 9123–Paints: Field painting of specified components; repainting of existing field painted Fire & Smoke door frames.
 - 3. 28 3000–Detection and Alarm: Provisions for smoke detectors.
 - 4. Division 26 Sections for 120VAC and control circuit power including conduit, boxes, conductors, wiring devices, and emergency power.

1.2 REFERENCES

- A. NFPA Codes and Standards:
 - 1. 70 – National Electrical Code.
 - 2. 105 – Recommended Practice for the Installation of Smoke-Control Door Assemblies.
 - 3. 72-2002 and 2007 – National Fire Alarm Code
 - 4. 80 – Standard for Fire Doors and Other Opening Protectives
- B. International Building Code
 - 1. 2018.
- C. UL Standards:
 - 1. 268 – Smoke Detectors for Fire Protective Signaling Systems.
 - 2. 508 – Industrial Control Equipment.
 - 3. 864 – Control Units for Fire Protective Signaling Systems.
 - 4. 1784 – Air Leakage Tests for Door Assemblies.

1.3 SUBMITTALS

- A. Reference Section –Submittal Procedures; submit following items:
 - 1. Product Data.
 - 2. Shop Drawings: Include door width and height, jamb width, jamb and head projection, curtain width, mounting height, and housing width. Show and identify related work performed under other sections of the specifications.
 - 3. Quality Assurance/Control Submittals:
 - a. Qualifications:
 - 1) Proof of manufacturer qualifications.

- 2) Proof of Installer qualifications.
- b. Certifications: Copy of specified items.
- c. Manufacturer's installation instructions and testing procedures

1.4 CLOSEOUT SUBMITTALS

- A. Comply with Section –Closeout Submittals; submit following items:
 - 1. Operation and Maintenance Manual
 - 2. Manufacturer's Warranties

1.5 QUALITY ASSURANCE

- A. Overall Standards:
 - 1. Manufacturer shall maintain a quality control program in accordance with ISO 9001:2008.
 - 2. Manufacturer shall maintain an in-plant UL follow up inspection procedure.
- B. Qualifications:
 - 1. Manufacturer Qualifications: Minimum ten years' experience in producing smoke and fire protection closures.
 - 2. Installer Qualifications: Factory approved by manufacturer.
- C. Certifications:
 - 1. Proof of compliance with:
 - a. NFPA 105
 - 2. Underwriters Laboratories
 - a. UL Standard 10D 3hr Listing Label
 - b. UL standard 1784 Listing Label
 - c. ASTM E84 Listing Label
- D. Pre-Installation Meeting:
 - 1. Schedule and convene a pre-installation meeting prior to commencement of field operations with representatives of the following in attendance: Owner, Architect, General Contractor, smoke containment system sub-contractor, painting sub-contractor, and electrical sub-contractor.
 - 2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
 - 3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications or installation instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Reference Section –Product Storage and Handling Requirements.
- B. Follow manufacturer's instructions.

1.7 WARRANTY

- A. Provide manufacturer's standard two year warranty.
- B. Inspection, Maintenance and Testing:

1. Perform minimum annual inspection and testing on each fire and smoke containment system as required by NFPA 80, manufacturer's warranty, and as otherwise required by the local authority having jurisdiction.
2. Provide inspection and test documentation.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer:
 1. CornellCookson, 24 Elmwood Drive, Mountain Top, PA 18707
www.cornellookson.com
 - a. Cornel Model SmokeShield™ Fire & Smoke
- B. Acceptable alternate Manufacturers include but are not limited to:
 1. Mckee Door
 2. Substitutions per Sections Substitution Procedures
- C. Label each fire and smoke containment system with following information:
 1. Manufacturer's name.
 2. Label of listing agency.
 3. Fire protection rating.
 4. Air leakage label

2.2 PERFORMANCE REQUIREMENTS

- A. Fire Protection rating tested and labeled to UL10D 3hr.
- B. Air Leakage: Not to exceed 3 cfm (0.001416 m³/s) per sf of door opening at 0.1 in (25 Pa) water pressure differential at ambient temperature and 400 degrees F (204 degrees C) tested and labeled to UL 1784 per IBC 2006, 2009, and 2012

2.3 COMPONENTS

- A. Construct the curtain head box from 20 gauge structural components with a 24 gauge pre finished galvanized steel cover.
- B. Provide a removable headbox cover allowing full width access to the assembly and curtain.
- C. Headbox Finish: Standard powder coated finish.
- D. Mounting: Above ceiling mounted to structure as indicated in drawings
- E. Guides: Provide 14 GA cold rolled steel standard powder coated finish. Size: 3-5/8 inches (57.2 mm) wide; 1-3/4 inch.
 1. Concealed installation in gypsum board as indicated in drawings
- F. Provide guide assemblies that expose no visible fasteners or shadow lines.

- G. Provide bottom bar composed of steel shapes sufficient to prevent deflection during a fire event and to blend into surrounding finishes where specified with standard powder coat to match ceiling finish.
- H. Provide a barrel constructed of steel tubing of sufficient geometry to limit deflection to less than 1/32" per foot of opening width.
- I. Provide intermediate support rollers capable of preventing barrel deflection into the opening under the extreme heat conditions of a fire event as a UL listed component.
- J. Provide a tubular shaped motor residing within the barrel that includes a 115 volt A.C. motor, planetary gearbox assembly, failsafe release mechanism and centrifugal governor.
- K. Provide a tubular motor assembly constructed of all-metallic components that will not sustain flame or contribute to combustion during a fire event.
- L. Provide a flush mount key switch to operate the curtain open and closed.
- M. Provide a motor controller housed in a steel enclosure that may be mounted in numerous positions or locations for maximum versatility.
- N. Provide a battery backup system to prevent curtain deployment during power outages for up to 8 hours.
- O. Provide an integral centrifugal governing system that does not require battery or electrical power, and controls curtain descent to 8" – 12" per second.
- P. Provide curtain material as tested and listed that includes F-920 filament fiberglass with stainless steel wire reinforcement.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates upon which work will be installed.
 - 1. Verify related work performed under other sections is complete and in accordance with Shop Drawings.
 - 2. Verify wall surfaces and Fire & Smoke door frames are acceptable for installation of system components.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

3.2 INSTALLATION

- A. Install smoke and fire system components in accordance with manufacturer's installation instructions.

3.3 FIELD QUALITY CONTROL

- A. Field Test: Follow manufacturer's cycle test procedures.

1. Notify Owner's Representative, local Fire Marshal, alarm sub-contractor and minimum one week in advance of scheduled testing.
2. Complete inspection and drop test documentation.

3.4 DEMONSTRATION

- A. Demonstrate required testing and maintenance procedures to Owner's Representative.
- B. Maintenance and Testing:
 1. Perform minimum annual inspection and drop testing on each unit as required by the manufacturer's warranty, NFPA 80, or under direction of the local authority having jurisdiction.
 2. Retain a record of tests per NFPA 80.

END OF SECTION 083483

SECTION 083613 - 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:
 - 1. Sectional-door assemblies.
- B. Related Requirements:
 - 1. Section 055000 "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. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for 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. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.
- B. Manufacturer's warranty.

- C. Finish warranty.

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 provisions in the ICC A117.1 applicable to sectional doors.

1.7 WARRANTY

- A. Manufacturer's 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: Two years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 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: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
 - 3. 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 door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.
- 4. Operability under Wind Load: Design sectional doors to remain operable under design wind load, acting inward and outward.
- C. Seismic Performance: Provide sectional doors that withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
 - 1. Component Importance Factor: 1.0.

2.3 SECTIONAL-DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 - 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. C.H.I. Overhead Doors, Inc.
 - b. Clopay Building Products.
 - c. Overhead Door Corporation.
 - d. Raynor Garage Doors.
- B. Basis of Design product: Overhead door series 592
- C. Operation Cycles: Door components and operators capable of operating for not less than 100,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- D. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. (2.03 L/s per sq. m) when tested in accordance with ASTM E283 or DASMA 105.
- E. U-Value: 0.149 Btu/sq. ft. x h x deg F (0.845 W/sq. m x K).
- F. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G60 (Z180) zinc coating.
 - 1. Door-Section Thickness: 3 inches
 - 2. Section Faces:
 - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
 - b. Exterior Face: Fabricated from single sheets, not more than 24 inches (610 mm) high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Steel Sheet Thickness: 0.019-inch (0.48-mm) nominal coated thickness.
 - 2) Surface: Manufacturer's standard.

- c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
 - 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of 0.019 inch (0.48 mm).
 - 3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch (1.63-mm) nominal coated thickness and welded to door section.
 - 4. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.
 - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
 - b. Hardware Locations: Provide reinforcement for hardware attachment.
 - 5. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:
 - a. Board Insulation: Polyurethane, secured to exterior face sheet.
 - b. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
 - c. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.
- G. Track: Manufacturer's standard, galvanized-steel, track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
 - 1. Lift: Standard or high lift, slope to ceiling per door location and details
 - 2. Material: Galvanized steel, ASTM A653/A653M, minimum G60 (Z180) zinc coating.
 - 3. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 - 4. Track Reinforcement and Supports: Provide 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 (51 mm) apart for door-drop safety device.
 - a. Horizontal Track: Provide 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.
- H. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.
- I. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:
 - 1. Insulating Glass Units: Manufacturer's standard.

- J. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
 - 1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch (2.01-mm) nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
 - a. 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.
 - b. Provide double-end hinges where required for doors more than 16 ft. (4.88 m) wide unless otherwise recommended by door manufacturer in writing.
 - 2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - a. Roller-Tire Material: Case-hardened steel.
- K. Locking Device:
 - 1. Chain Lock Keeper: Suitable for padlock.
 - 2. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.
- L. Counterbalance Mechanism:
 - 1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
 - 2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 - b. Provide one additional midpoint bracket for shafts up to 16 ft. (4.88 m) long and two additional brackets at one-third points to support shafts more than 16 ft. (4.88 m) long unless closer spacing is recommended in writing by door manufacturer.
 - 3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
 - 4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
 - 5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
 - 6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
- A. Electric Door Operator:
 - 1. Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
 - 2. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
 - 3. Operator Location: Top of hood.

4. 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 ft. (2.44 m) or lower.
 5. Motor Exposure:
 - a. Unless Noted Otherwise: Interior.
 - b. WB04 & WB05: Interior, wet, and humid
 6. Motor Electrical Characteristics:
 - a. Horsepower: As recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
 - b. Voltage: 460 V ac, three phase, 60 Hz.
 7. Emergency Manual Operation: Chain type.
 8. Obstruction-Detection Device:
 - a. Shop Doors, Wash Bay
 - 1) Automatic photoelectric sensor
 - 2) Electric sensor edge on bottom bar.
 - b. Tire Storage, and Parts
 - 1) Electric sensor edge on bottom bar.
 - c. Sensor Edge Bulb Color: Black .
 9. Control Station(s):
 - a. All
 - 1) Interior mounted.
 - 2) Push-button operated control stations with open, close, and stop buttons
 - b. Wash Bay Doors
 - 1) Rated for wet locations
 - 2) WB04, WB05: Vehicle detector operation coordinated with vehicle wash system
 10. Egress Switch: G222A
 - a. Push-pull button – with mushroom head
- B. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
1. Factory Prime Steel Finish: Compatible with field-applied finish and in manufacturer's standard color. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 - a. Color and Gloss: Grey.

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. 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; in accordance with manufacturer's written instructions.
- B. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches (610 mm) 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 in accordance with UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

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.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

SECTION 083900 - PRESSURE-RESISTANT DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single flood plank barrier with jambs, planks, sill, and latching hardware.

B. Related Sections:

1. Division 04 – Concrete Unit Masonry
2. Division 05 – Structural Steel Framing.

1.2 SUBMITTALS

A. Manufacturer's data sheets on each product to be used, including:

1. Storage and handling requirements and recommendations.
2. Installation instructions.

B. Shop Drawings: Provide shop drawings showing layout, profiles, and product components, including anchorage, hardware, and finishes. Include dimensional plans, applicable material specifications, elevations and sections detailing mounting and connections, and load diagrams.

1.3 CLOSEOUT SUBMITTALS

A. Closeout Submittals: Provide Operation and Maintenance data to include methods for maintaining installed products, precautions against cleaning materials and methods detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer must demonstrate a minimum of five (5) years successful experience in design and manufacture of similar flood related closures. Upon request, provide supporting evidence including list of installations, descriptions, name and method of contact.

B. Minimum Qualifications: Manufacturer must demonstrate compliance and certification of a Quality Management System administered by the International Organization for Standardization (ISO). Documentation of current certification status to be provided upon request.

C. Welder Qualifications: Welders Certified in accordance with American Welding Society Procedures for applicable material used in production of specified product.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging container with identification labels intact until ready for installation.
- B. Protect materials from exposure to moisture during storage.
- C. Store materials in a dry, warm, ventilated weathertight location. If outdoor storage is required, block materials to store at an incline, to prevent pooling of any moisture and promote runoff. Tarp materials in a tent-like arrangement, elevated above the product with open sides to allow airflow. Store all other hardware in a dry controlled environment.
- D. Use caution when unloading and handling product to avoid bending, denting, crushing, or other damage to the product.
- E. When using forklifts, use forks of proper length to fully support product being moved. Consult Approved for Construction drawings or consult with factory for proper lift points.

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 manufacturer's indicated limits.

1.7 COORDINATION

- A. Conduct site survey and provide to flood barrier manufacturer, prior to manufacturers' commencement of shop drawings; the actual site conditions of the mounting location, to include; material type, dimensions and configuration, interferences with mounting surface, or any other condition that may impact the ability of the flood barrier to be properly installed.
- B. Coordinate work with other operations and installation of adjacent materials to avoid damage.

1.8 WARRANTY

- A. Manufacturer's Standard Warranty: Product to be free from defects in material and workmanship for a period of one (1) year from date of shipment.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Design watertight flood planks to support, solely or in combinations of, temporary super- imposed live loads as indicated below. All applied types of flood related loadings are transferred from the flood product barriers, solely or in combinations of, by mullion

anchorage to structural floor slabs and/or jamb anchorage and direct pressure contact to structural walls or other structural elements.

1. Hydrostatic Loading.
 2. Hydrodynamic Loading.
 3. Debris Impact Loading.
 4. Wave Loading (Dynamic/ Non-Breaking or Broken Wave).
 5. Wave Loading (Impact/Breaking Wave – Below & Above DFE).
 6. Wind Loading.
- B. Engineering Code Practices: Engineer flood products to conform to the design requirements that are based on the latest adopted edition of the International Building Code (IBC). LRFD and/or ASD methodologies are applied as appropriate to align with specific project specifications and/or limited published material data.
- C. Water Density: 64 pcf, unless otherwise noted on “Approved for Construction” drawings.
- D. Deployment: No sealant required on planks during deployment – watertight protection that deploys quickly without mess or drying time.

1.2 MANUFACTURERS

- A. Watertight Flood Plank Barriers:
1. Approved Manufacturer: PS Flood Barriers™, which is located at: 1150 S. 48th Street, Grand Forks, ND 58201; Toll Free Tel: 877.446.1519; Email: 4psinfo@psindustries.com; Web: www.psfloodbarriers.com or www.psindustries.com
 - a. Basis of Design Product: Model: FP 530/FP 535.
- B. Single Source Responsibilities: Obtain all watertight barriers and flood plank assemblies from single manufacturer.

2.3 EQUIPMENT

- A. Products Details:
1. Sealing Requirements: Flood Plank and gasket design shall provide an effective barrier against short-term high-water situations, to the protection level indicated on drawings.
 2. Latching: Provide with pad-lockable latching to secure deployed barrier from tamper or theft. One (1) latch per jamb.
 3. Operation: Flood Planks and latches to be non-handed to allow for reversible installation.
 4. Mounting/Load Transfer: Anchor to existing structure. Flood Plank designed for specified hydrostatic pressure (and other loads as specified) and will transfer loads to adjacent structure.
 5. Frame to be cast-in-place or anchored utilizing mechanical, chemical or other framing methods as designed. Manufacturer to include all anchors, water-stop,

- and sealants, as designed, unless otherwise noted.
6. Jamb mounting location:
 - a. Wall Face Mount:
 - 1) Positive Pressure Loading, (direction of loading against flood plank so as to force the barrier against the wall structure - "seating").

2.4 MATERIALS

- A. Flood Plank: Aluminum: 6000 Series alloy.
- B. Gaskets: Factory mounted, compressible rubber type, field replaceable. Gasket does not require air inflation.
 1. Material: UV resistant EPDM unless otherwise noted.
- C. Frame to include jamb and optional sill members for field locating and installation on structure. Jamb members to be designed and fabricated with appropriate material as required for the loading.
 1. Aluminum of appropriate size and strength with welded or mechanical fastened construction.
- D. Sill:
 1. Flat sill with anchors, Stainless Steel Type 304, mill finish.
- E. Frame Mounting Hardware: Provide anchors, sealant, and water stop, as required.
- F. Operating Hardware:
 1. Provide hardware sized for the size and weight of the flood plank and loads.
 2. Hardware to be factory located on jambs and plank panels, as practical.
 3. Latching hardware to be as indicated on the "Approved for Construction" Drawings.
 4. Flood plank panel to be factory prepared for applicable latching devices.
- G. Aluminum: Mill finish, welds ground smooth, not polished.
- H. Labeling. Each watertight plank and jamb will be individually identified for matched installation.
- I. Instruction Placard: Provide pictorial and written operation instruction placards on flood plank.

2.5 FABRICATION

- A. Fit and factory assemble items in largest practical sections, for shipment to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Supply components required for anchorage of fabrications, unless otherwise noted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another subcontractor, notify Architect of uncompleted preparation before proceeding.
- C. Inspect opening for compliance with flood plank manufacturer requirements. Verify opening conditions are within required tolerances.

3.2 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.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions, "Approved for Construction" Drawings, shipping, handling, and storage instructions, and product carton instructions for installation.
- B. Sills, jambs, and mullions shall be installed level, square, plumb, and rigid.
- C. Sealants, water-stop, and grouting to be completed by appropriate personnel, and in accordance with product application directions, manufacturer's instructions, and "Approved for Construction" Drawings.
- D. Tolerances: All dimensional requirements must be in accordance with manufacturer's installation instructions and "Approved for Construction" Drawings.
- E. Products to be operated and field verified that sealing surfaces maintain contact at the correct sealing points.
- F. Inspect gaskets for damage, wear, and adhesion. Replace compromised gaskets immediately.
- G. Verify that latching assemblies operate freely and correctly.
- H. Verify all anchorage is in accordance with manufacturer's installation instructions and applicable data sheets.
- I. Inspect installation sealants to ensure a watertight juncture.

3.4 FIELD QUALITY CONTROL

A. Field Testing:

1. Installer to perform visual dry test for gasket alignment, continuity contact and pre- compression.
2. Installer to perform hose test of barrier to frame in accordance with manufacturer's standard Hose Test Procedure.
3. Installer to construct temporary water barrier and test installed flood barrier under hydrostatic conditions.

3.5 CLEANING

- A. Touch-up, repair or replace damaged products or components before Substantial Completion.
- B. Clean all sealing surfaces.

3.6 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION 083900

SECTION 084313 – ALUMINUM ENTRANCES AND STOREFRONT SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Delegated engineering, glazed aluminum storefront window system, and accessories indicated, specified, or required to complete installation.
- B. Aluminum-framed storefront, with vision glass.
- C. Weatherstripping.

1.2 RELATED REQUIREMENTS

- A. Section 051200 - Structural Steel Framing: Steel attachment members.
- B. Section 055000 - Metal Fabrications: Steel attachment devices.
- C. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 087100 - Door Hardware: Hardware items other than specified in this section.
- E. Section 088000 - Glass and Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- E. AAMA 612 - Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum; 2017a.
- F. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
- G. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

- I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- J. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- K. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- L. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2019c.
- M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.
- N. 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).
- O. 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.
- P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.4 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents: Concept of work specified by this Section is expressed on Drawings and in Specifications. However, they may not indicate or specify full extent of work that may be required.
- B. Delegated Engineering Responsibility: Require manufacturer to employ a delegated engineering professional to provide engineering for work of this Section to comply with concept expressed in Contract Documents.
 - 1. Engineer system to withstand structural design loads within limits and under conditions indicated, specified, or required, without material failure or permanent deformation of building structural frame or work specified according to following:
 - a. Applicable local building codes.
 - b. ASCE 7 or the more stringent Building Code requirements.
 - c. Authorities having jurisdiction.
 - d. Wind tunnel testing.
 - e. Criteria indicated in Contract Documents.
- C. Prepare engineering calculations, shop drawings, and other submittals and affix professional seal by a Registered Engineer in the State of Nevada, according to respective jurisdictional licensing regulations.
- D. Coordination of Contract Documents and Work:

1. Notify Owner and Architect of potential constructability issues between Contract Documents and execution of work. Absence of notice constitutes acceptance of conditions indicated, specified, or required, and changes caused by minor differences between delegated engineering and Contract Documents will be at no additional cost to Owner.
 2. Minor adjustments may be made in interest of fabrication or installation methods, techniques, or ability to satisfy concept expressed in Contract Documents, provided concept is maintained as determined by Owner and Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including additional design and construction costs.
- E. Delegated Engineering Assumptions:
1. Allowable working stress no more than yield stress of material.
 2. Corners and Wind Pressures:
 - a. Corners in Typical Windload Zones: Both surfaces shall be assumed to experience inward and outward design pressures simultaneously.
 - b. Corners in Corner Windload Zones: Simultaneous occurrence of inward design pressure on one surface, and outward design pressure on adjoining surface is not required.
 3. A 1/3 increase in allowable working stress for wind is not acceptable.
 4. Glass, sealants and interior finishes shall not contribute to framing member strength, stiffness or lateral stability.
 5. Compression flanges of flexural members may be assumed to receive effective lateral bracing only from anchors to building structure and horizontal glazing rails or interior trim, which are in contact with compression flange. Points of contraflexure shall not be regarded as lateral braces or as end points of an unbraced length; unbraced length shall be actual distance between effective lateral braces.
 6. Where a framing member reaction is resisted by a continuous element, maximum assumed effective length of resisting element shall be 4 times bearing length, but not more than 12 in.
 7. Properly brace assembly anchors in 3 orthogonal directions (vertical, transverse, and longitudinal) to resist loads from any direction, including, but not limited to, inward positive and outward negative wind pressures.
 8. Following transfers of loads onto building structure is not acceptable:
 - a. Application of moments to floor slab edge.
 - b. Application of lateral or torsional loads to steel beams and columns.
 9. All loading into the mullions must have a load path that transfer loading directly into the structure. Mullions can not be fully supported by adjacent or interlocking members.
- F. Safety Factors: Engineer to withstand following load effects without exceeding allowable working stress by following safety factors:
1. Concrete Inserts: 3.
 2. Structural Steel: As determined by delegated engineering professional consistent with engineering quality standards.
 3. Welded Headed Studs: 2.
 4. Cold-Formed Steel: As determined by delegated engineering professional consistent with engineering quality standards.
 5. Cold-Formed Stainless Steel: As determined by delegated engineering professional consistent with engineering quality standards.

6. Aluminum: As determined by delegated engineering professional consistent with engineering quality standards.
 7. Post-Installed Anchors in Concrete: 5 according to ASTM E 488.
 8. Cast-in-Place Concrete Inserts: 4 according to ASTM E 488.
 9. Drilled expansion or wedge type anchors: 4
- G. Engineering Quality Standards: Determine allowable working stresses of products according to the following unless other standards are required by authorities having jurisdiction or applicable local building codes:
1. ASCE – American Society of Civil Engineers
 - a. SEI/ASCE 7, Minimum Design Loads for Buildings and Other Structures.
 2. Concrete: ACI 318 – Building Code Requirements for Structural Concrete.
 3. Structural Steel:
 - a. AISC – Manual of Steel Construction.
 - b. AISC 303 – Code of Standard Practice for Steel Buildings and Bridges.
 - c. AISC 360 – Specification for Structural Steel Buildings.
 - d. AISC 341 – Seismic Provision for Structural Steel Buildings, including Supplement No.1.
 - e. AISC – Manual of Steel Construction, Load Resistance Factor Design Specification for Structural Steel Buildings.
 4. Aluminum:
 - a. AA – Aluminum Structures: A Guide to their Specifications and Design.
 - b. AA – Aluminum Design Manual.
 5. Glass: AAMA-CW-12 – Structural Properties of Glass.
 6. Welding:
 - a. ANSI/AWS – D1.1 – Structural Welding Code – Steel.
 - b. ANSI/AWS – D1.3 – Structural Welding Code – Sheet Steel.
 - c. ANSI/AWS – D1.2 – Structural Welding Code – Aluminum.
 7. Slotted Channel Framing: MFMA-4.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.6 SUBMITTALS

- A. See Section 013300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
- C. Shop Drawings: Prepared by Storefront Contractor, with detailed plans, elevations, sections, and large-scale details of products; include the following:
 1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
 2. Descriptions, indicate system dimensions, types, sizes, and profiles of products; including those concealed.
 3. Framed opening requirements and tolerances.

4. Manufacturers, products, types, sizes, lengths, spacings, embedment, and edge distances of anchors, fasteners, and attachment devices.
 5. Insert/embed drawings and erection diagrams.
 6. Types of welded connections using AWS welding symbols.
 7. Loose, cast-in, and field-set hardware, inserts, and connections.
 8. Manufacturers, products, types, thicknesses, and layers of finishes.
 9. Material, thicknesses, profiles, and other details for flashings, gutters, and drainage troughs.
 10. Route for infiltrated water and condensation drainage to exterior.
 11. Provisions for expansion and contraction, including dimension limits of movement for moving joints.
 12. Fabrication, assembly and installation tolerances.
 13. Maximum and minimum joint sizes, including sealants and backer rods.
 14. Material descriptions, types, sizes, and profiles for isolation between dissimilar surfaces.
- D. Delegated Engineering Calculations: Engineering calculations, sealed by delegated engineering professional in the State of Nevada, for portion of work designated as delegated engineering.
1. Test reports not acceptable substitute for calculations.
 2. Certification of conformance with structural test pressures and design pressures indicated; submit product test reports with notations as required by professional engineer.
- E. Delegated Engineering Calculations for Deviated Condition: In the event of a deviation due to, caused by, or required by conditions that varies from Contract Documents or previously approved submittals, new or revised engineering calculations, sealed by delegated engineering professional.
- F. Samples: Submit two samples 12 by 12 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- G. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (300 mm) lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- H. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- I. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- J. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

- K. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- L. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- M. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with AAMA SFM-1 and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual and AAMA - Aluminum Curtain Wall Design Guide Manual.
- B. Source Limitations: Obtain aluminum framed storefront system through one source from a single manufacturer.
- C. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at Nevada.
- D. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least 10 years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Insulating Glass Certification Council (IGCC).
 - b. Safety Glazing Certification Council (SGCC).
- E. Installer Qualifications: Company specializing in performing work of type specified and with at least 5 years of documented experience.
- F. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project systems with minimum [5] years of documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.9 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

- A. See Section 017000 - Contract Closeout, for additional warranty requirements.

- B. Correct defective Work within a five year period after Date of Substantial Completion.
 - 1. Defects, Faulty Work, and Failures: Include, but not limited to, following:
 - a. Structural failure of components resulting from specified forces and loads.
 - b. Thermal movement causing damage to interior or exterior finishes, buckling, joint opening, glass breakage, excessive strain on structural members, undue stress on fasteners and anchors, failure of sealants, reduction of performance, or other detrimental affects.
 - c. Noise or vibration caused by thermal movement or wind.
 - d. Deflection exceeding specified limits.
 - e. Framing members transferring stresses to glazing.
 - f. Loss of glass bite due to shifting glass.
 - g. Loss of glass bearing on setting blocks due to shifting glass and/or blocks.
 - h. Loosening or weakening of fasteners, anchors, and other components.
 - i. Failure of fasteners, anchors, and attachment metals due to electrolytic damage, deterioration of protective coatings, or oxidation.
 - j. Deterioration of gaskets or lack of sufficient pressure on glass causing air infiltration or water penetration.
 - k. Failure of operating and moving components to function properly.
 - l. Air infiltration in excess of specified limits.
 - m. Water penetration or condensation in excess of specified limits.
 - n. Staining of exposed surfaces due to incompatibility of adjacent products.
 - o. Failure to fulfill other specified performance requirements.
 - p. Failure of finishes:
 - 1) Cracking, peeling, crazing, pitting, or corroding discernible from a distance of 10 ft .
 - 2) Color fading: N not more than 5 Hunter units according to ASTM D 2244 on exposed surfaces cleaned with clean water and soft cloth. Includes non-uniform fading to extent there are color differences between adjacent panels.
 - 3) Chalking: Not more than No. 8 rating according to ASTM D 4214 on exposed unwashed surfaces.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
- E. This warranty and its enforcement shall not deprive the Owner of other action right or remedy available to him.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and

design concept expressed in Contract Documents is not changed, as determined by the Architect.

1. Approved Products: Storefront:
 - a. Basis of Design: Tubelite, Inc. 14000 Series

- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections:

1. Kawneer North America: www.kawneer.com/#sle.
2. Substitutions: See Section 016310 - Substitutions.

2.2 PRODUCTS, GENERAL

- A. Single Source Responsibility: Furnish each type of product through one source from single manufacturer.
- B. Manufacturer Names or Labels: Not acceptable on exposed faces of products; printed label or stamped metal nameplate indicating manufacturer's name and product model number is acceptable on an easily noticeable interior surface or on back surface.
- C. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.

2.3 EXTERIOR ALUMINUM-FRAMED STOREFRONT

- A. Aluminum Framed Storefront: Tubelite T14000 Series Thermally Broken Storefront system as manufactured by Tubelite, Inc. of Walker, MI: Factory or field fabricated, field glazed, factory finished aluminum, screw spline or shear block construction with infill and related flashings, anchorage and attachment devices.
 1. System dimensions: 2" x 4-1/2"
 - a. Exterior face dimensions:
 - 1) Primary mullions: 2"
 - b. Depth: 4-1/2"
 - c. Corner mullions: As detailed on Drawings
 2. Glazing: As specified in Section 088000 - Glass and Glazing.
 - a. Position: center of system
 - b. Thickness: 1"
 - c. Method: outside glazed
 3. Head Receptor:
 - a. One piece head receptor
 - b. Two piece head receptor
- B. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
- C. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

- D. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
- E. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
- F. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- G. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
 - 1. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

2.4 INTERIOR ALUMINUM FRAMED STOREFRONT

- A. Aluminum Framed Storefront: Tubelite E14000 Series Non-Thermally Broken Storefront system as manufactured by Tubelite, Inc. of Walker, MI: Factory or field fabricated, field glazed, factory finished aluminum, screw spline or shear block construction with infill and related flashings, anchorage and attachment devices.
 - 1. System dimensions: 2" x 4-1/2"
 - a. Exterior face dimensions:
 - 1) Primary mullions: 2"
 - b. Depth: 4-1/2"
 - c. Corner mullions: As detailed on Drawings
 - 2. Glazing: As specified in Section 088000 - Glass and Glazing.
 - a. Position: center of system
 - b. Thickness: 1/4"
 - c. Method: outside glazed
 - 3. Head Receptor:
 - a. One piece head receptor
 - b. Two piece head receptor

2.5 PERFORMANCE REQUIREMENTS

- A. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - 1. Design Wind Loads: Comply with requirements of ASCE 7.
 - 2. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
- B. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 and AAMA 501.1 (Dynamic) at pressure differential of 12 lbf/sq ft.

- C. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.24 psf pressure differential across assembly.
- D. Thermal Movement Resistance:
 - 1. Withstand expansion and contraction movement of framing members and components without excessive thermal movement according to AAMA 501.5.
 - 2. Base calculations on actual surface temperatures due to both solar heat gain and night time sky heat loss.
 - a. Ambient Temperature Range: Plus 170 deg F to minus 10 deg F.
 - b. Surface Temperature: 180 deg F.
- E. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.6 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Framing members for interior applications need not be thermally broken.
 - 2. Glazing Stops: Flush.
 - 3. Cross-Section: As indicated on drawings.
 - 4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Perimeter Fire Barrier System
 - 1. Components of the perimeter fire barrier system included in the work of this section must be securely installed in accordance with applicable ASTM E2307 or ASTM E119 tests.
- C. Glazing: As specified in Section 088000 - Glass and Glazing.
- D. Integral Venetian Blinds: (Optional), Where indicated.
 - 1. 5/8" or 1" wide aluminum slat blinds. Blind color shall be selected by the Architect from standard color chart.
 - 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.

2.7 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by sliding aluminum-framed glass door manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" wall thickness at any location for the main frame and sash members.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with sliding aluminum-framed glass door members, trim hardware, anchors, and other components.

- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
 - D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
 - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.
 - E. Extruded Aluminum: ASTM B221 (ASTM B221M).
 - F. Sheet Aluminum: ASTM B209 (ASTM B209M).
 - G. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
 - H. Structural Supporting Anchors: See Section 051200.
 - I. Fasteners: Stainless steel.
 - J. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.
 - K. Concealed Flashings: Galvanized steel, 26 gauge, 0.0179 inch minimum base metal thickness.
 - L. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
 - M. Sealant for Setting Thresholds: Non-curing butyl type.
 - N. Glass: As specified in Section 088000.
 - 1. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
 - 2. Glazing Accessories: As specified in Section 088000.
 - O. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.
 - P. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.
- 2.8 FINISHES
- A. Surface to be finished shall be free from mechanical imperfections such as scratches, scrapes, dents and die marks.

- B. Factory finish all surfaces that will be exposed in completed assemblies.
- C. Concealed members may be mill finish, providing that they cannot be seen through the glass, do not contact any structural silicone or are not continually exposed to water immersion.
- D. Appearance of Finished Work:
 - 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
 - 2. Noticeable variations in same piece are not acceptable.
 - 3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.
 - 4. Architect has the final authority to accept or reject any or all material not meeting specified standards or requirements of the Contract Documents.
- E. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: Custom color, match architect's sample
- F. Protection of Finish: Protect exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.
- G. Touch-Up Materials: As recommended by coating manufacturer for field application.
- H. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
- I. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

2.9 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: As specified in Section 087100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- E. Threshold: Extruded aluminum, one piece per door opening, non-slip surface; provide on all doors.

2.10 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly yet enabling installation and dynamic movement of perimeter seal.

- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce interior horizontal head rail to receive drapery track brackets and attachments.
- G. Reinforce components internally for door hardware .
- H. Reinforce framing members for imposed loads.
- I. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.2 INSTALLATION

- A. Installation Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:
 - 1. Delegated engineering.
 - 2. Respective manufacturer's written instructions, specifications, and recommendations.
 - 3. Approved submittals.
 - 4. Contract Documents.
 - 5. ASTM E 2112 Standard Practice for Installation of Exterior Windows, Doors and Skylights
- B. Install wall system in accordance with manufacturer's instructions.
- C. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- D. Provide alignment attachments and shims to permanently fasten system to building structure.

- E. Prevent galvanic action and other forms of corrosion by isolating metals from direct contact with incompatible surfaces.
- F. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- G. Provide thermal isolation where components penetrate or disrupt building insulation.
- H. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- I. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- J. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- K. Set thresholds in bed of sealant and secure.
- L. Install glass in accordance with Section 80 13, using glazing method required to achieve performance criteria.
 - 1. No “smash glazing” practices are allowed. All field-glazed applications shall be able to be caulked after the glass is set, no exceptions.
- M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES: CONFORM TO FOLLOWING NON-CUMULATIVE TOLERANCES:

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
 - 1. Variation for Vertical Members:
 - a. Not more than 1/8 inch in 26 ft.
 - b. Not more than 1/4 inch in 52 ft.
 - 2. Variation for Horizontal Members: Not more than 1/8 inch in 25 ft in any direction.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
- C. Offset from Alignment of Members End to End: Not more than 1/32 inch
- D. Gap Between Removable Members: Not more than 1/16 inch, or not more than 1/32 inch at each end of single member.
- E. Variation in Plane: One of following:
 - 1. Not more than 1/16 inch in 10 ft at any location.
 - 2. Not more than 1/8 inch over entire face or area.
- F. Sealant joint width between Mullions and adjacent construction: minimum of 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
- B. Re-testing and Re-inspections Due to Failures: Contractor is responsible for expenses incurred, without additional cost to Owner, due to failure of work to pass testing and inspections.
- C. Weepage System: Mask weeps and introduce water to interior areas to demonstrate weepage performance.
 - 1. Fill gutters to average $\frac{3}{4}$ inch height and hold for 30 minutes.
 - 2. No leakage to interior spaces is allowed.

3.5 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.6 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Remove all mastic smears or other unsightly marks from the installed work. Perform final cleaning and washing of glass and aluminum.
- C. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- D. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.7 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 084313

SECTION 085113 – EXTERIOR 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 internal blind.
- B. Related Requirements:
 - 1. Section 088000 “Glazing” for additional glazing requirements for Aluminum Windows.

1.3 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Manufacturer and Installer.

1.5 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.

1.6 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.
2. Warranty Period:
 - a. Window: 5 years from date of Substantial Completion.
 - b. Glazing Units: 5 years from date of Substantial Completion.
 - c. Aluminum Finish: 5 years from date of Substantial Completion.

PRODUCTS

1.7 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide 1150 Series, 2-inch AW (Architectural Window) Thermally Broken Window w/ internal blind and hinged access sash by Winco, or approved equal.
 1. Both interior and exterior lites 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.
 2. Integral Blinds where indicated. Provide manufacturer's standard integral blind operation hardware.
- B. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

1.8 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.

1.9 ALUMINUM WINDOWS

- A. Operating Types: Provide the following operating types in locations indicated on Drawings:
 1. Fixed.
 2. Awning
- B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
 1. Thermally Broken Construction: Fabricate frames and sashes 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, low E coated, exterior lite, clear interior lite.
 - b. Kind: 5/16-inch laminated lites on both window faces.
 2. Lites: Two.
 3. Filling: Fill space between glass lites with air.
- D. Integral Blind:
 1. Head rail shall be 1.085-inch wide x .875-inch high x .050-inch thick with bottom rail being 1.000-inch wide x .355-inch high x .050-inch thick of 6063-T5 extruded aluminum alloy and temper with a baked on polyester powder coat finish conforming to AAMA Specifications #603.8-1985. WACI standard color: Antique White.
 2. Ladder cord location shall not exceed 6-inches from the end of the slot or 24-inches apart.
 3. The control knob shall be designed with slip feature to minimize damage due to overt tilting of blind. Knob to be exterior mount with 45 degree downward facing angle. WACI part number 5161.
- 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. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

- H. 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.

1.10 ACCESSORIES

- A. Sub Sill: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

1.11 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.

1.12 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.

1.13 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: Custom color, match architect's sample

PART 2 - EXECUTION

2.1 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. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 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

2.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust 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.
- E. END OF SECTION 085113

SECTION 085619 - TRANSACTION WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sliding, transaction windows.
- B. Related Requirements:
 - 1. Section 084113 "Aluminum Entrances and Storefront Systems" for surrounds.

1.2 COORDINATION

- A. Coordinate installation of anchorages for transaction 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.

1.3 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 transaction windows.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Hardware for sliding window units.
 - 3. Glazing details.
 - 4. Details of transaction counter.
- C. Samples for Verification: For frame members with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Examination reports documenting inspections of substrates, areas, and conditions.
- C. Field quality-control reports documenting inspections of installed products.
 - 1. Field quality-control certification signed by Contractor.
- D. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Pack transaction windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.
- B. Label transaction window packaging with drawing designation.
- C. Store crated transaction windows on raised blocks to prevent moisture damage.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

- A. Manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 SLIDING, TRANSACTION WINDOWS

- A. Provide sliding, transaction windows.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Ready Access; 600 Series or a comparable product by one of the following:
 - a. C.R. Laurence Co., Inc.; CRH Americas, Inc.
 - b. Protective Structures, Ltd.
- B. Configuration: One fixed-glazed panel and one horizontal-sliding glazed panel.
- C. Operation: Manual open/manual closing.
- D. Framing: Fabricate perimeter framing, mullions, and glazing stops from aluminum as follows:
 - 1. Profile: Manufacturer's standard, with minimum face dimension indicated.
 - a. Minimum Face Dimension: 2 inches (50 mm).
 - 2. Depth: Manufacturer's standard.
- E. Head and Jamb Framing: Designed for sealant glazing. Removable header access panel on secure side.
- F. Sliding Window Hardware: Provide roller track designed for overhead support of manufacturer's standard carrier supporting horizontal-sliding glazed panel. Provide self-latching and manufacturer's standard pull and lock with thumb turn.
- G. Glazing and Glazing Materials: 3/4" insulated glass.
- H. Materials:

1. Metallic-Coated Steel Sheet: ASTM A653/A653M, CS (Commercial Steel), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
2. Aluminum Extrusions: ASTM B221 (ASTM B221M). Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength.
3. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M).

2.2 FABRICATION

- A. General: Fabricate transaction windows to provide a complete system for assembly of components and anchorage of window units.
- B. 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 transaction windows to comply with ballistics-resistance performance indicated.
- C. Glazing Stops: Finish glazing stops to match transaction window framing.
- D. 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.
- E. Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated. Installation orientation of glazing to meet performance requirements.
- F. Weather Stripping: Factory applied.

2.3 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.

2.4 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 1. Color and Gloss: Match Architect's sample.

2.5 METALLIC-COATED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.

2.6 ACCESSORIES

- A. Glazing Strips and Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Molded EPDM or neoprene gaskets complying with ASTM D2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C509, Grade 4.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric backing.
- B. 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).
- C. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B633; provide sufficient strength to withstand design pressures indicated.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Sealants: For sealants required within fabricated transaction windows, provide type recommended by manufacturer for joint size and movement. Sealant remains 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 transaction windows.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Fasteners: Install transaction windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials.
- B. Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.
- C. 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.

3.3 FIELD QUALITY CONTROL

- A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
- B. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- C. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

3.4 ADJUSTING

- A. Adjust horizontal-sliding, transaction windows to provide a tight fit at contact points for smooth operation and a secure enclosure.
- B. Remove and replace defective work, including transaction windows that are warped, bowed, or otherwise unacceptable.

3.5 CLEANING AND PROTECTION

- A. Clean surfaces promptly after installation of transaction windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.
 - 1. Lubricate sliding transaction window hardware.
- B. Clean glass of preglazed transaction windows promptly after installation.
- C. Provide temporary protection to ensure that transaction windows are without damage at time of Substantial Completion.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain operable transaction windows.

END OF SECTION 085653

SECTION 087100 - DOOR HARDWARE

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 commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 06 Section "Plastic Laminate Clad Architectural Cabinets"
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Flush Wood Doors".
 - 4. Division 08 Section "Fiberglass Doors",
 - 5. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 6. **Division 28 for door security and access control systems.**
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 - 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.

- b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 - 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
 - D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
 - E. Informational Submittals:
 - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
 - F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- 1.4 QUALITY ASSURANCE
- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
 - B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
 - C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
 - D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 - 3. Review sequence of operation narratives for each unique access controlled opening.
 - 4. Review and finalize construction schedule and verify availability of materials.
 - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 DOOR OPERATING TRIM

- A. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 - 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

6. Manufacturers:

- a. Ives (I).
- b. Rockwood (RO).
- c. Trimco (TC).

2.3 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Match Facility Restricted Keyway.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. Key Quantity: Provide the following minimum number of keys:
 1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed.
 1. Manufacturers:
 - a. Marks Hardware (MX) - 5 Series.

- b. No Substitution.
- B. Cylindrical Locksets, Grade 1 (Commercial Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed.
 - 1. Locks are to be non-handed and fully field reversible.
 - 2. Manufacturers:
 - a. Marks Hardware (MX) – 195 Series.
 - b. No Substitution.

2.5 AUXILIARY LOCKS

- A. Cylindrical Deadlocks: ANSI/BHMA A156.36 Grade 1 Certified Products Directory (CPD) listed deadlocks to fit standard ANSI 161 preparation. Provide tapered collars to resist vandalism and 1" throw solid steel bolt with hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other locksets.
 - 1. Manufacturers:
 - a. Schlage (SC) - B600 Series.

2.6 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.7 ELECTRIC STRIKES

- A. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.
 - 1. Manufacturers:
 - a. HES (HS) - 9400/9500/9600/9700/9800 Series.
- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.8 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - 4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - 5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
 - a. Von Duprin (VD) - 35A/98 XP Series.
 - b. No Substitution.

2.9 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

- B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers:
 - a. LCN Closers (LC) - 4040XP Series.
 - b. No Substitution.

2.10 SURFACE MOUNTED CLOSER HOLDERS

- A. Electromagnetic Door Holders: ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate 12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:
 - a. Norton Rixson (RF) - 980/990 Series.

2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
 - a. Ives (IV).
 - b. Rockwood (RO).
 - c. Trimco (TC).

- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of

extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.12 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. National Guard Products (NG).
 2. Pemko (PE).
 3. Reese Enterprises, Inc. (RE).

2.13 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.14 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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 work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 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.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

- 1. Quantities listed are for each pair of doors, or for each single door.
- 2. The supplier is responsible for handing and sizing all products.
- 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
- 4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

- B. Manufacturer's Abbreviations:

- 1. ALL listed items are basis of design except manufacturers indicated prior in this section with no substitutions

- 1. IV - Ives
- 2. RO - Rockwood
- 3. DE - Detex Corporation
- 4. MX - Marks
- 5. SC - Schlage
- 6. VD - Von Duprin
- 7. MC - Medeco
- 8. HS - HES
- 9. RF - Rixson
- 10. LC - LCN Closers
- 11. PE - Pemko
- 12. OT - Other

Hardware Sets

Set: 1

Doors: X101

Description: Main Entry Doors

2 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV
1 Mullion	90KR		DE
2 Rim Exit Device, Lever	99L	626	VD
2 SFIC Core	33600006K S	26	MC
2 Rim Cylinder SFIC Housing	33-07603H	26	MC
2 Surface Closer	4040XP EDA	689	LC
1 Mullion Gasketing	5110BL		PE
1 Gasketing	S44BL		PE
2 Sweep	18061CNB		PE
1 Threshold	Per Detail & Field Conditions x FHSL14		PE

Set: 2

Doors: X102, X119, X140

Description: Secondary Entry Doors (Office)

1 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV	
1 Rim Exit Device, NL Lever	CD 99L-NL 996L-NL	626	VD	
1 SFIC Core	33600006K S	26	MC	
1 Rim Cylinder SFIC Housing	33-07603H	26	MC	
1 Surface Closer	4040XP EDA	689	LC	
1 Electric Strike	9600	630	HS	⚡
1 SMART Pac Bridge Rectifier	2005M3		HS	⚡
1 Power Supply	AQDx (size as reqd)		SU	⚡
1 Card Reader, DPS, REX	By Security Contractor		OT	
1 Gasketing	S44BL		PE	
1 Sweep	18061CNB		PE	
1 Threshold	Per Detail & Field Conditions x FHSL14		PE	

Set: 3

Doors: X220A, X220B, X220C, X220D, X221A, X221B

Description: Shop Entry Doors

1 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV	
1 Rim Exit Device, NL Lever	CD 99L-NL 996L-NL	626	VD	
1 SFIC Core	33600006K S	26	MC	
1 Rim Cylinder SFIC Housing	33-07603H	26	MC	
1 Surface Closer	4040XP EDA	689	LC	
1 Electric Strike	9600	630	HS	⚡
1 SMART Pac Bridge Rectifier	2005M3		HS	⚡
1 Power Supply	AQDx (size as reqd)		SU	⚡
1 Card Reader, DPS, REX	By Security Contractor		OT	
1 Gasketing	S44BL		PE	
2 Kickplate	K1050 10" High x CSK	US32D	RO	
1 Sweep	18061CNB		PE	
1 Threshold	Per Detail & Field Conditions x FHSL14		PE	

Set: 4

Doors: X152

Description: Fire Riser, Wash Bay

3 HD Hinges	T4A3386 4.5 x 4.5 NRP	630	MCK	
1 Storeroom Lock	195F	US26D	MX	
1 Cylinder	20200V1- S	26	MC	
1 Kickplate	K1050 10" High x CSK	US32D	RO	
1 Door Stop	471 EXP	US26D	RO	
1 Surface Closer	4040XP EDA	689	LC	
1 Gasketing	S44BL		PE	
1 Threshold	Per Detail & Field Conditions x FHSL14		PE	

Set: 5

Doors: X225

Description: Shop Storage

2 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV
1 Storeroom Lock	195F	US26D	MX
1 Cylinder	20200V1- S	26	MC
4 Kickplates	K1050 10" High x CSK	US32D	RO
1 Deadbolt	B663 B	626	SC
1 Top and Bottom Flush Bolts	557	626	RO
1 Gasketing	S44BL		PE
1 Threshold	Per Detail & Field Conditions x FHSL14		PE

Set: 11

Doors: 102

Description: Interior Vestibule Doors

2 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV
1 Mullion	90KR		DE
2 Rim Exit Device, Lever	99L	626	VD
2 SFIC Core	33600006K S	26	MC
2 Rim Cylinder SFIC Housing	33-07603H	26	MC
2 Surface Closer	4040XP EDA	689	LC
1 Mullion Gasketing	5110BL		PE
1 Gasketing	S44BL		PE
2 Sweep	18061CNB		PE

Set: 12

Doors: 110, 111, 112, 114, 115, 116, 118, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 141, 202, 203, 224

Description: Office Doors - Lockset

3 HD Hinges	T4A3386 4.5 x 4.5 NRP	630	MCK
1 Office Lock	195	US26D	MX
1 Cylinder	20200V0- S	26	MC
1 Door Stop	471 EXP	US26D	RO
3 Silencer	608		RO

Set: 13

Doors: 117

Description: Conference Room Door - Lockset

3 HD Hinges	T4A3386 4.5 x 4.5 NRP	630	MCK
1 Passage Lock	195N	US26D	MX
1 Cylinder	20200V0- S	26	MC
1 Door Stop	471 EXP	US26D	RO
3 Silencer	608		RO

Set: 14

Doors: 119A, 119B, 140

Description: Break and Training Rooms - Lockset

3 HD Hinges	T4A338 6 4.5 x 4.5 NRP	630	MCK
1 Office Lock	195	US26D	MX
1 Cylinder	20200V 0- S	26	MC
1 Door Stop	471 EXP	US26D	RO
1 Surface Closer	4040XP EDA	689	LC
1 Gasketing	S44BL		PE

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Set: 15

Doors: 120, 138A, 143, 304, 305, 306, 307

Description: Storage and Mechanical - Lockset

3 HD Hinges	T4A3386 4.5 x 4.5 NRP	630	MCK
1 Storeroom Lock	195F	US26D	MX
1 Cylinder	20200V0- S	26	MC
1 Door Stop	471 EXP	US26D	RO
1 Gasketing	S44BL		PE

Set: 16

Doors: 121, 122, 210, 213

Description: Multi-Occupancy Restroom, Locker Room Vestibule, Men's Locker Room

3 HD Hinges	T4A3386 4.5 x 4.5 NRP	630	MCK
1 Push Pull Set	110x73C/73CL	US32D	RO
1 Surface Closer	4040XP RW/PA	689	LC
2 Kickplate	K1050 10" High x CSK	US32D	RO
1 Wall Stop	409	US32D	RO
3 Silencer	608		RO

Set: 17

Doors: 200

Description: Shops Public Corridor

2 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV
1 Mullion	90KR		DE
2 Rim Exit Device, Lever	99L	626	VD
2 SFIC Core	33600006K S	26	MC
2 Rim Cylinder SFIC Housing	33-07603H	26	MC
2 Surface Closer	4040XP EDA	689	LC
4 Kickplate	K1050 10" High x CSK	US32D	RO
1 Mullion Gasketing	5110BL		PE
1 Gasketing	S44BL		PE

Set: 18

Doors: 204

Description: Parts Double Doors

2 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV
1 Auto Flush Bolt Set	2842 / 2942	US32D	RO
1 Dust Proof Strike	570	US26D	RO
1 Lever Set, Office	195	US26D	MX
2 Cylinder	20200V0- S	26	MC
1 Coordinator	2600 x FB x Mtg Brkts	US28	RO
4 Kickplate	K1050 10" High x CSK	US32D	RO
2 Surface Closer	4040XP EDA	689	LC
1 Door Stop	471 EXP	US26D	RO
1 Gasketing	316APK		PE
2 Sweep	18061CNB		PE
1 Overlapping Astragal	357SP (or by door mfr)		PE

Set: 19

Doors: 211, 212

Description: Women's Locker and single Occupancy Restroom

3 HD Hinges	T4A3386 4.5 x 4.5 NRP	630	MCK
1 Privacy Lock, w/ Indicator	5LF RW92 A17	US26D	MX
1 Surface Closer	4040XP RW/PA	689	LC
2 Kickplate	K1050 10" High x CSK	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S44BL		PE
1 Coat Hook	790	US26D	RO

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Set: 20

Doors: 302A

Description: Mezzanine Access Door

1 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV
1 Lever Set, Passage	195N	US26D	MX
1 Cylinder	20200V0- S	26	MC
1 Surface Closer	4040XP EDA	689	LC
1 Gasketing	S44BL		PE

Set: 21

Doors: 223, 303A, 303B

Description: Air Compressor & Oil Storage

3 HD Hinges	T4A3386 4.5 x 4.5 NRP	630	MCK
1 Storeroom Lock	195F	US26D	MX
1 Cylinder	20200V1- S	26	MC
4 Kickplates	K1050 10" High x CSK	US32D	RO
1 Deadbolt	B663 B	626	SC
1 Top and Bottom Flush Bolts	557	626	RO
1 Gasketing	S44BL		PE
Wall Stop	409	US32D	RO

Set: 22

Doors: 201

Description: Secure Corridor From Offices: Interior - Panic - Non-rated

1 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV
1 Rim Exit Device	99L -2 996L	626	VD
2 SFIC Core	33600006K S	26	MC
2 Rim Cylinder SFIC Housing	33-07603H	26	MC
1 Surface Closer	4040XP RW/PA	689	LC
2 Kickplate	K1050 10" High x CSK	US32D	RO
1 Wall Stop	409	US32D	RO
1 Gasketing	S44BL		PE

Set: 23

Doors: 220, 221

Description: Shop Access from Corridor - Panic - Fire rated

1 Continuous Hinge	112HD / 224HD (verify type w/door & frame mfr)	628	IV
1 Fire Rated Rim Exit, Storeroom	99L-NLF 996L-NL	626	VD
1 SFIC Core	33600006K S	26	MC
1 Rim Cylinder SFIC Housing	33-07603H	26	MC
1 Surface Closer,	4040XP CUSH	689	LC
2 Kickplate	K1050 10" High x CSK	US32D	RO
1 Gasketing	S44BL		PE
1 Wall Stop	409	US32D	RO

Set: 31

Doors: Miscellaneous lock cores where indicated throughout drawings including but not limited to field shutters, casework locks, and security grille locks

Provide Medeco cores where possible for indicated locking mechanisms

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass products.
 - 2. Laminated glass.
 - 3. Insulating glass.
 - 4. Glazing sealants.
 - 5. Glazing tapes.
 - 6. Miscellaneous glazing materials.
 - 7. **Spandrel Glass**

1.2 RELATED REQUIREMENTS

- 1. 081113 – Hollow Metal Doors and Frames
- 2. 081613 – Fiberglass Doors
- 3. 081616 – Flush Wood Doors
- 4. 084313 – Aluminum Entrances and Storefront Systems
- 5. 085113 – Exterior Aluminum Windows
- 6. 088813 – Fire Resistant Glazing

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 in accordance with 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 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, product locations, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; **12 inches (300 mm)** square.
- C. Glazing Accessory Samples: For sealants, in **12-inch (300-mm)** lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016310 – Substitutions for additional provisions
 - 2. Extra Insulating Glass Units: One of each glass size and each glass type

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturers of fabricated glass units.
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass, for tests performed by a qualified testing agency.
- D. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer with a minimum ten 10 years of documented experience.
- B. Installer Qualifications: A qualified glazing contractor specializing in performing work of the type specified and with at least five 5 years of documented experience.
- C. The Contractor shall assume undivided responsibility for the glass and glazing and coordination with the components of related work. This firm must demonstrate not less than five years successful experience at work similar to the work of this project.

Provide at least one person who shall be thoroughly trained and experience in the skills required, who shall be completely familiar with the referenced standards and the requirements of this work, and who shall personally direct all installation performed under this Section of these specifications.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with 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.

1.10 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 are below **40 deg F (4.4 deg C)**.

1.11 WARRANTY

- A. See Section 01700 – Contract Closeout for additional warranty requirements.
- B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate 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.
- C. 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: Five years from date of Substantial Completion.
- D. 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 obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

- E. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

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 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 in accordance with the IBC and ASTM E1300:
1. Design Wind Pressures: As indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 2. 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 (25 mm), whichever is less.
 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- 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 of thickness indicated.
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, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as **Btu/sq. ft. x h x deg F (W/sq. m x K)**.
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

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. NGA 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 another certification agency acceptable to authorities having jurisdiction 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 the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
- 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.

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. Guardian Glass LLC.
 - b. Pilkington North America; NSG Group.
 - c. PPG.
 - d. Saint-Gobain Glass Corp.
 - e. Oldcastle Glass
 - f. Vitro Architectural Glass.
- 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.
- C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- D. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.
 1. **Basis-of-Design Product:** Subject to compliance with requirements, provide Pilkington; Energy Advantage combined with Pilkington Solar-E Pyrolitic hard coatings or a comparable product by one of the following:
 - a. Viracon
 - b. Vitro Architectural Glass
 - c. Guardian Glass LLC.
 - d. Pilkington North America; NSG Group.
 - e. Saint-Gobain Glass Corp.
 - f. AGC Glass Company.
- E. Mirror Glass: Heat Strengthened, ASTM C 1048, HT, Type 1, Class 1, q2-Mirror Quality with silver and copper plate backing and polished edges. Provide for direct adhesive mounting.
- F. **Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.**
 1. **Color: As selected by architect from manufacturer's full range.**

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. **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. Kuraray America, Inc.
 - b. Pilkington North America; NSG Group.
 - c. Saflex; Eastman.
 2. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.

3. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
4. 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 in accordance with ASTM E2190.
 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2.7 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. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, 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. GE Construction Sealants; Momentive Performance Materials Inc.; SilPruf LM SCS2700.
 - b. Pecora Corporation; 864.
 - c. Pecora Corporation; 890.
 - d. The Dow Chemical Company; 790.
 - e. Tremco Incorporated; Spectrem 3.

2.8 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by 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: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 - 1. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

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.

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 all existing glazing intended to receive Bullet Resistant Film to manufacturer's written instructions.

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 (1270 mm).
 - 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- (3-mm-) 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 in accordance with 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. Install Bullet Resistant Films at existing glazing surfaces per manufacturer's written instructions.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Center glass lites in openings on setting blocks, and press firmly against tape 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.

3.5 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 in writing 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 in writing by gasket manufacturer.

- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. 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 glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 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 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.

3.8 GLASS SCHEDULE

- A. Glass Type G01 - Exterior: Low E Insulated:
 - 1. Minimum Thickness of Outdoor Lite: 1/4".
 - 2. Outdoor Lite: Clear fully tempered float glass.
 - 3. Interspace Content: Argon.
 - 4. Indoor Lite: Clear laminated glass with two plies of annealed float glass.
 - a. Minimum Thickness of Each Glass Ply: 5/32".
 - b. Interlayer Thickness: 0.060 inch (1.52 mm).
 - 5. Low-E Coating: Pyrolytic Hard Coat on second (Solar-E) and sixth (Energy Advantage) surfaces
 - 6. Summer U-Factor: 0.24 maximum for total assembly.
 - 7. Visible Light Transmittance: 48 percent minimum.

- 8. SGHC: 0.37 maximum.
- 9. Safety glazing required.

- B. Glass Type G02 - Interior: Fully tempered float glass.
 - 1. Minimum Thickness: 1/4".
 - 2. Safety glazing required.

END OF SECTION 088000

SECTION 088813 - FIRE-RATED GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fire-protection-rated glazing for doors and transoms.

1.2 DEFINITIONS

- A. Fire-Protection-Rated Glazing: Glazing that prevents spread of fire and smoke and complies with requirements for rated openings; incapable of blocking radiant heat
- B. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- C. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches (300 mm) square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of glass and glazing product.
- B. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the NGA's Certified Glass Installer Program.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during remainder of construction period.

1.9 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: Five years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Tempered Glazing Units with Clear Intumescent Interlayer: Manufacturer agrees to replace units that deteriorate within specified warranty period. Deterioration of tempered glazing units with clear intumescent interlayer is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning glass contrary to manufacturer's written instructions. Evidence of failure is air bubbles within units, or obstruction of vision by contamination or deterioration of intumescent interlayer.

1. Warranty Period: **[Five]** **[10]** **<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Glass: For each glass type, obtain from single source from single manufacturer.
- B. Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Low-Iron Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear), with visible light transmission not less than 91 percent.
- C. Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise 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.
- D. 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 unless fire-protection or fire-resistance rating is based on another product.
 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING

- A. General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing in accordance with NFPA 257 or UL 9, including hose-stream test, and shall comply with NFPA 80.
 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from hose-stream test.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether glazing has passed hose-stream test; whether glazing meets 450 deg F (250 deg C) temperature-rise limitation; and fire-resistance rating in minutes.
- C. Fire-Protection-Rated Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; complying with 16 CFR 1201, Category II.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Technical Glass Products; an Allegion brand ; FireLite Plus®. or a comparable product by one of the following:
 - a. McGrory Glass, Inc.
 - b. Vetrotech Saint-Gobain.

2.6 GLAZING ACCESSORIES

- A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications 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. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. The Dow Chemical Company.
 - c. Tremco Incorporated.
 2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- C. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- D. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing

materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Perimeter Insulation for Fire-Resistance-Rated Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.8 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

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 fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. 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.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- E. 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.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
 - 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- (3-mm-) 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.
- H. 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 in accordance with requirements in referenced glazing publications.
- I. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 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.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances. 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 glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 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 contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.

END OF SECTION 088813

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fixed extruded-aluminum louvers.

1.2 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.
 2. Samples: Provide architect with physical color chart.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on tests performed according to AMCA 511.

1.4 WARRANTY

- A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 511.

2.2 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal drainable blade Louver:
1. Louver Depth: 4 inches.
 2. Manufacturers: Subject to compliance to equipment specification on the drawings, provided products by one of the following:
 - a. Greenheck
 - b. Pottorff
 - c. Or approved equal
 3. Frame and Blade Nominal Thickness: Not less than 0.081 inch for blades and 0.081 inch for frames.
 4. Mullion Type: Exposed.
 5. Louver Performance Ratings:
 - a. See drawings for performance requirements.
 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 7. Manufacturer's seal extensions.

2.3 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Bird screening.
 - 3. Screen to be same color as louver.

2.4 MATERIALS

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
 - 2. For color-finished louvers, use fasteners with heads that match color of louvers.
- C. Post installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

2.5 FABRICATION

- A. 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.
- B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 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. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- D. 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.

3.2 ADJUSTING

- A. 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.

END OF SECTION 089119

SECTION 090561 – COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Epoxy Flooring and Wall Systems
 - 2. Vinyl Backed Cushioned Carpet
 - 3. Entry Mat Carpet Tile
- B. Preparation of new concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
 - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- E. Patching compound.
- F. Remedial floor coatings.

1.2 RELATED REQUIREMENTS

- A. Section 014000 – Quality Requirements: Additional requirements relating to testing agencies and testing.
- B. Section 033000 – Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.
- C. Section 033000 – Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.
- D. Section 033511 – Concrete Floor Finishes for Ground and Polished Concrete System
- E. Section 096566 – Resilient Athletic Flooring
- F. Section 096720 – Epoxy Flooring and Wall Systems
- G. Section 096813 – Entry Mat Carpet Tile
- H. Section 096816 – Vinyl Backed Cushion Carpet

1.3 REFERENCE STANDARDS

- A. ASTM C109/C109M – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2020b.
- B. ASTM C472 – Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 2020.
- C. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).
- D. ASTM F1869 – Standard Test Method for measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- E. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs using in situ Probes; 2019a.
- F. RFCI (RWP) – Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate Scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.5 SUBMITTALS

- A. See Section 013000 – Submittal Requirements, for submittal procedures.
- B. Floor Covering and Adhesive Manufacturer's Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
- D. Testing Agency's Report:
 - 1. Description of areas tested; include floor plans and photographs if helpful.
 - 2. Summary on conditions encountered.
 - 3. Moisture and alkalinity (pH) test reports.
 - 4. Copies of specified test methods.
 - 5. Recommendations for remediation of unsatisfactory surfaces.
 - 6. Include certification of accuracy by authorized official of testing agency.
 - 7. Submit report to Architect.
 - 8. Submit report not more than two business days after conclusion of testing.
- E. Adhesive Bond and Compatibility Test Report.
- F. Floor Moisture Testing Technician Certificate: International Concrete repair Institute (ICRI) Concrete Slab Moisture Testing Technician – Grade I certificate.

1.6 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- D. Contractor's Responsibility Relating to Independent Agency Testing:
 - 1. Provide access for and cooperate with testing agency.
 - 2. Confirm date of start of testing at least 10 days prior to actual start.
 - 3. Allow at least 4 business days on site for testing agency activities.
 - 4. Achieve and maintain specified ambient conditions.
 - 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.8 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.

2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
 3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

PART 3 - EXECUTION

3.1 CONCRETE SLAB PREPARATION

- A. Follow recommendations of testing agency.
- B. Perform following operations in the order indicated:
1. Preliminary cleaning.
 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 5. Specified remediation, if required.
 6. Patching, smoothing, and leveling, as required.
 7. Other preparation specified.
 8. Adhesive bond and compatibility test.
 9. Protection.
- C. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.2 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.3 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

3.4 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.5 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
 - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
 - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
 - 3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
- C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.6 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with recommendations of testing agency.
- C. Comply with requirements and recommendations of floor covering manufacturer.
- D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- E. Do not fill expansion joints, isolation joints, or other moving joints.

3.7 ADHESIVE BOND AND COMPATABILITY TESTING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.8 APPLICATION OF REMEDIAL FLOOR COATING

- A. Comply with requirements and recommendations of floor covering manufacturer.

3.9 PROTECTION

- A. Cover prepared floors with building paper or other durable covering.

END OF SECTION 090561

SECTION 092216 - 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. Division 05 Section "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.
 - 2. Division 07 Section "Building Insulation" for insulation installed in metal framing.
 - 3. Division 09 Section "Gypsum Board".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For EQ steel studs and runners and firestop tracks, from ICC-ES.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of light gage metal framing that are similar to those indicated for this Project in material, design, and extent.

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. Clark/Dietrich Building Systems.
 - 2. Marino/Ware.
 - 3. CEMCO.
 - 4. Phillips Manufacturing.
 - 5. Telling Industries, Inc.

2.2 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 E 119 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 E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Structural Performance: Provide lightgauge metal framing capable of withstanding loads within limits and under conditions indicated.
 - 1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Gypsum Board Finish: Horizontal deflection of 1/240 of the wall height.
 - b. Cement Backer Board Finish: Horizontal deflection of 1/360 of the wall height
 - 2. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/4 inch.

2.3 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:
 - a. Minimum Base-Metal Thickness: 0.033 inch (20 Gage).
 - b. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide the following:
 1. 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.
 - 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) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; Slotted Deflecto Track.
 - 3) Steel Network Inc. (The); VertiTrack VTD Series.
 - 4) Superior Metal Trim; Superior Flex Track System (SFT).
 - 5) Telling Industries; Vertical Slip Track II.
- E. 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.
 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. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.033 inch (20 gage) unless otherwise noted on drawings.
- G. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.033 inch (20 gage) unless otherwise noted on drawings.
 2. Depth: 7/8 inch unless otherwise noted on drawings.
- I. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: Asymmetrical or hat shaped.
- J. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 3/4 inch unless otherwise noted on drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.

2.4 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, 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.
 - a. Type: Postinstalled, chemical or expansion anchor.
 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 A 641/A 641M, 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: 2 inches unless otherwise noted 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 C 645.
 - a. Minimum Base-Metal Thickness: 0.033 inch (20 gage).
 - b. Depth: 1-5/8 inches unless otherwise noted on drawings.
 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 0.033 inch (20 gage).
 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 C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 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. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Grid System.
 - c. USG Corporation; Drywall Suspension System.

2.5 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.
- 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. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 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. Set runners at floors in two continuous beads of acoustical sealant.
 - 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. Screw to wood framing.
 - 2. 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 attach hangers to steel roof deck.
 - 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 7. 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 092216

SECTION 092900 - 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 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Texture finishes.
- B. Related Requirements:
 - 1. Division 06 Section "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
 - 3. Division 09 Section "Painting" for finish coatings and paints applied to substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
 - 2. Textured Finishes: 12 inch square for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 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.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 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 E 119 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 E 90 and classified according to ASTM E 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. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum LLC; or a comparable product by one of the following:
 - a. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - b. PABCO Gypsum.

- c. [USG Corporation](#).
 2. Thickness: **5/8 inch (15.9 mm)**.
 3. Long Edges: Tapered.
- B. Ceiling Gypsum Board, Type X: ASTM C1396/C1396M.
 1. [Basis-of-Design Product](#): Subject to compliance with requirements, provide [Georgia-Pacific Gypsum LLC](#); or a comparable product by one of the following:
 - a. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - b. [PABCO Gypsum](#).
 - c. [USG Corporation](#).
 2. Thickness: **5/8 inch (15.9 mm)**.
 3. Long Edges: Tapered.
 4. Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut
- C. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 1. [Basis-of-Design Product](#): Subject to compliance with requirements, provide [Georgia-Pacific Gypsum LLC](#); or a comparable product by one of the following:
 - a. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - b. [PABCO Gypsum](#).
 - c. [USG Corporation](#).
 2. Thickness: **1/4 inch (6.4 mm)**.
 3. Long Edges: Tapered.
- D. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
 1. [Basis-of-Design Product](#): Subject to compliance with requirements, provide [Georgia-Pacific Gypsum LLC](#); or a comparable product by one of the following:
 - a. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - b. [PABCO Gypsum](#).
 - c. [USG Corporation](#).
 2. Core: **5/8 inch (15.9 mm)**, Type X.
 3. Long Edges: Tapered.
 4. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.4 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.
 1. [Basis-of-Design Product](#): Subject to compliance with requirements, provide [Georgia-Pacific Gypsum LLC](#); or a comparable product by one of the following:
 - a. [CertainTeed; SAINT-GOBAIN](#).
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company.
 - c. [USG Corporation](#).

2. Core: **5/8 inch (15.9 mm)**, Type X.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet, or rolled zinc.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. Expansion (control) joint.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions 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. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
 2. Exterior Gypsum Soffit Board: Paper.
 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 4. 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, rounded or beveled panel edges, 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.
 3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use setting-type, sandable topping or drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound, drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

- D. Joint Compound for Tile Backing Panels:
 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 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. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 2. 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).
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

2.8 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Non-Aggregate Finish: Pre-mixed, vinyl texture finish for spray application.
 - 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 Corp.; ProRoc Easi-Tex Spray Texture.
 - b. National Gypsum Company; Perfect Spray EM Texture.
 - c. USG Corporation; BEADEX FastTex Wall and Ceiling Spray Texture.
 - 2. Texture: Orange Peel.

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 C 840.
- 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 C 919 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.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Type X: All interior surfaces unless otherwise indicated.
 2. Flexible Type: As indicated on Drawings; apply in double layer at curved assemblies.
 3. Ceiling Type: Ceiling surfaces.
 4. Moisture- and Mold-Resistant Type: As indicated on Drawings.
 5. Acoustically Enhanced Type: As indicated on Drawings.
- 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.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 2. 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.
 3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- E. 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 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 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. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. Bullnose Bead: Use at outside corners where indicated.
 3. LC-Bead: Use at exposed panel edges and where gypsum panels are abutted to other construction and back flange can be attached to framing or supporting substrate.

- 4. L-Bead: Use where edge trim can only be installed after gypsum panels are installed.
- 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 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 in accordance with ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, fire rated wall areas above finished ceilings, and where indicated.
 - a. Joints and interior angles shall have tape embedded in joint compound.
 - b. Surface shall be free of excess joint compound
 - c. Tool marks and ridges are acceptable
 - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive applied wall panels, wood paneling, applied products, etc.
 - a. Joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating joint compound over joints and interior angles.
 - b. Fastener heads and accessories shall be covered with a coat of joint compound.
 - c. Surface shall be free of excess joint compound.
 - d. Tool marks and ridges are acceptable.
 - e. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.
 - 3. Level 3: Not used.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated. Not to be used where gloss, semi-gloss and enamel paints are to be applied.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 - b. Joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over flat joints and one separate coat of joint compound applied over interior angles.
 - c. Joint compound shall be smooth and free of tool marks and ridges
 - d. Surface to be coated with Drywall Primer as specified herein prior to application of texture.

- e. Untextured surfaces to be coated with Drywall Primer prior to application of final finishes.
 - 5. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finishes, wall coverings, and at wall areas indicated to receive epoxy wall systems.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 - b. Joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over flat joints and one separate coat applied over interior angles.
 - c. Fastener heads and accessories shall be covered with 3 separate coats of joint compound
 - d. A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to the entire surface to fill imperfections in the joint work, smooth the paper texture and provide a uniform surface for decorating. Excess compound shall be immediately sheared off, leaving a film of skim coating compound completely covering the paper.
 - e. The surface shall be smooth and free of tool marks and ridges.
 - f. Surface to be coated with Drywall Primer as specified herein prior to application of texture.
 - g. Untextured surfaces to be coated with Drywall Primer prior to application of final finishes.
- E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.7 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 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 092900

SECTION 095113 - 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 acoustical panels and exposed suspension systems for ceilings.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

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. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Size and location of initial access modules for acoustical panels.
 - 4. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 5. Minimum Drawing Scale: 1/8 inch = 1 foot.

- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 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 Panels: Full-size panels equal to **2** percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to **2** percent of quantity installed.
 - 3. Hold-Down Clips: Equal to **2** percent of quantity installed.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 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.

1.10 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: 450 or less.
- C. 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 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- C. 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 reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- D. 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

- A. Manufacturers: Specific acoustical lay-in panels and suspension systems are indicated on the Finish Plans, to establish the design intent and required standard of quality. It is not intended to preclude the use of other acceptable 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. CertainTeed Corp.
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Mineral Based – ACT1 Ceiling Panels:
 - 1. Surface Texture: Fine
 - 2. Composition: Mineral Fiber
 - 3. Color: White
 - 4. Size: 24" x 24"
 - 5. Edge Profile: Beveled Tegular 15/16" for interface with PRELUDE XL 15/16" Exposed Tee grid.
 - 6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton 0.75
 - 7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton 35
 - 8. Flame Spread: ASTM E 1264; Class A (UL)
 - 9. Light Reflectance (LR) White Panel: ASTM E 1477; 0.88
 - 10. Dimensional Stability: HUMIGUARD Plus
 - 11. Basis of Design Product: ULTIMA Tegular, 1911 No added formaldehyde as manufactured by Armstrong World Industries
 - a. Or Equal

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
 - 1. Per UNR Standards: Ceiling suspension systems shall meet requirements of UBC Standard 25-2.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to **five** times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

2. 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 hangers of type indicated and with capability to sustain, without failure, a load equal to **10** times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (10 gage) diameter wire.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.
- I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.5 METAL SUSPENSION SYSTEM

- 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. CertainTeed Corp.
 3. Chicago Metallic Corporation.
 4. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Basis of Design Product: PRELUDE XL 15/16" Exposed Tee as manufactured by Armstrong World Industries
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than **G30** coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
 1. Structural Classification: Heavy-duty system.
 2. Face Design: Flat, flush.

3. Cap Material: Steel cold-rolled sheet.

2.6 METAL EDGE MOLDINGS AND TRIM

- 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. CertainTeed Corp.
 3. Chicago Metallic Corporation.
 4. Fry Reglet Corporation.
 5. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply 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. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. Edge Moldings and Trim:
 1. 7800 - 12' Wall Molding
- D. Accessories:
 1. BERC2 - Beam End Retaining Clip
- E. Optional Accessories
 1. 7904 - 15/16" Flush Act. to Drywall Transition Molding
 2. 7908 - 15/16" Tegular Act. to Drywall Transition Molding

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing 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 with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- 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

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M, UBC Standard 25-2, 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, countersplaying, 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. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. 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.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. 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.
 - 11. 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 postinstalled anchors.

- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - 2. 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.
 - 3. Do not use exposed fasteners, including pop rivets, 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. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 2. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
 - 3. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
 - 4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 - 1. Compliance of seismic design.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
 - 1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.

- b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096500 – RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Resilient base.
- B. Transition Strips, Moldings, Transition and Edge Strips
- C. Installation accessories.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- B. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- C. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3 REFERENCE STANDARDS

- A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers; 1998 (Reapproved 2015).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).
- D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.
- E. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).
- F. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.4 SUBMITTALS

- A. See Section 013300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

1. Include information stating Static Coefficient of Friction.
 2. MSDS
 - a. Submit Material Safety Data Sheets (MSDS) available for flooring products, adhesives, patching/leveling compounds, floor finishes (polishes) and cleaning agents.
 3. For resilient products. Use same designations indicated on Drawings.
- C. Shop Drawings: Indicate seaming plans, floor patterns, and _____.
- D. Verification Samples: Submit 4 samples, 6 by 6 inch in size illustrating color and pattern for each resilient product specified.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016310 - Substitutions, for additional provisions.
 2. Extra Wall Base: 100 linear feet of each type and color.
- 1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum 10 years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum 5 years documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.
- 1.6 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS
- A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
- B. Slip resistance of floor surfaces and changes in level shall be in accordance with applicable law.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.

- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.8 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.
- B. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

1.9 WARRANTY

- A. See Section 017836 - Warranties and Bonds, for additional warranty requirements.
- B. Resilient Products:
 - 1. Resilient Base: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient base that fails within the warranty period.
- C. Warranty Period
 - 1. Warranty Period: 2 years
- D. Rights
 - 1. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
 - 1. Approved Manufacturer(s): Refer to Drawings and Material Schedules.
 - a. As specified in this section for other products.
- B. Substitutions: Refer to Section 012500 - Substitution Procedures.

2.2 RESILIENT BASE

- A. Resilient Base Type B-1: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - 1. Approved Manufacturers:
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. Basis of Design: Johnsonite, a Tarkett Company: www.johnsonite.com.
 - c. Roppe Corporation: www.roppe.com/#sle.
 - d. Substitutions: See Section 016310 - Substitutions.
 - 2. Height: 4 inch.
 - 3. Thickness: 0.125 inch.
 - 4. Finish: Satin.
 - 5. Length: Roll.
 - 6. Color: As indicated on drawings.
 - 7. Accessories: Premolded external corners and internal corners.

2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips:
 - 1. For 1/4" to 1/2" flooring transitions height difference: Tarkett Wheeled Traffic Transition, Product CTA-XX-J.
 - 2. For up to 3/8" flooring transition height difference: Tarkett Reducer Transition, Product SSR-XX-B
 - 3. Refer to Drawings for Types, locations.
 - 4. Color: Black.
 - 5. Manufacturers: a. Basis of Design: Johnsonite, a Tarkett Company: www.johnsonite.com. b. Or Approved Equal. c. Substitutions: See Section 016310 - Substitutions.
- D. Filler for Coved Base: Plastic.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.2 PREPARATION

- A. Clean substrate.

3.3 INSTALLATION – GENERAL

- A. Install in accordance with manufacturer's written instructions.

3.4 INSTALLATION – RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.5 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.6 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 096500

SECTION 096720 – EPOXY FLOORING AND WALL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Epoxy flooring/cove base system as shown on the drawings and in schedules.
 - 2. Epoxy wall coating system as shown on the drawings and in schedules.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.
- B. Section 079200 - Joint Sealants.
- C. Section 090561 - Common Work Results for Flooring Preparation.
- D. Section 092116 - Gypsum Board Assemblies: Level 5 finish requirements.

1.3 REFERENCE STANDARDS

- A. ASTM C579 - Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- B. ASTM C580 - 02(2012) Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- C. ASTM D635 - 10 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- D. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2010.
- E. ASTM D790 - 10 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- F. ASTM D2240 - 05(2010) Standard Test Method for Rubber Property-Durometer Hardness.
- G. ASTM D4060 - 10 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
- H. ASTM D4541 - 09e1 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

- J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.
- K. ASTM E1745 - 11 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- L. ASTM F1869 - 11 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- M. AATCC Test Method 147-2011 Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method.
- N. UL 410 Standard for Safety for Slip Resistance of Floor Surface Materials.

1.4 SYSTEM DESCRIPTION

- A. Flooring Application:
 - 1. The work shall consist of preparation of the substrate, the furnishing and application of a cementitious urethane based self-leveling seamless flooring system with decorative chip broadcast and Epoxy broadcast and topcoats.
 - 2. The system shall have the color and texture as specified by the Owner with a nominal thickness of 3/16 inch. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
 - 3. Coved seamless wall base.
- B. Wall Application
 - 1. The work shall consist of preparation of the substrate, the furnishing and application of an epoxy-based wall coating system, with decorative colored chips and urethane topcoats. The system shall have the color and texture as specified by the Owner with a nominal thickness of 55 - 60 mils. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.

1.5 SUBMITTALS

- A. See Section 013000 - Submittal Requirements for Submittal Procedures.
- B. Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.
- C. Surfacing applicator shall submit samples of color and textures for Architect's approval.
- D. Samples: Submit, for verification purposes, 6 x 6 inch square samples of each type of resinous decking required, applied to a rigid backing, in color and finish indicated.
 - 1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

1.6 MOCK-UP

- A. Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
- B. Extent of mock-up shall be the same as that which will be provided in the final work.
- C. Personnel assembling mock-up shall be the same personnel that will perform the actual work at the project site.
- D. Mock-up shall be installed simulating actual construction conditions. Use means, methods and techniques proposed for final installation.
- E. Construct mock-up of resinous ceiling, wall, flooring, border and base illustrating appearance of finished work at corners and material transitions. Size mock-up to be not less than 6 x 6 x 6 feet.
- F. Locate where directed.
- G. Approved mock-up may not remain as part of the Work.
- H. Mock-up shall be subjected to testing criteria specified for final installation.

1.7 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and complexity; Stonhard or approved equal. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.
- B. Surfacing shall be applied by a surfacing applicator approved by the Architect, with a minimum of seven (7) years experience installing the brand of surfacing in similar size and function projects. A list of ten (10) completed projects using the specified materials must be submitted proving seven (7) years experience by the lead mechanic.
- C. Surfacing applicator shall provide to the architect a completed list of jobs including the names of the Architect, General Contractor, and Owner, telephone numbers of all concerned, materials used, quantity installed and date completed on similar projects.
- D. Surfacing applicator must provide a written joint guarantee for materials and workmanship between applicator and surfacing manufacturer for one (1) year.
- E. Surfacing applicator or manufacturer seeking approval of products other than what is specified must supply samples, full product information, technical data with specifications, certification from an independent testing laboratory that the product being submitted for approval meets all requirements of the performance properties specified within this specification, installation instructions and comply with the above quality assurances in writing fourteen (14) days before bid letting.

1. Omission of any item will result in an automatic rejection.
2. Bidders will be notified by addendum of substitute surfacing materials, if approved.

- F. Static Coefficient of Friction: Provide floor products and finished floor installations with a wet and dry static coefficient of friction of 0.6 minimum for level surfaces and treads of stairs and 0.8 minimum for ramp surfaces as tested.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.
- B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.
- C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 85°F/16 and 30°C.
- D. Material temperatures shall be a minimum of 55°F before use.
- E. Work on seamless flooring shall not commence until the building can be maintained at a minimum temperature of 55 °F for 48 hours before, during and 48 hours after application. Areas shall also be broom clean and reasonably dust free and shall have adequately controlled ventilation with bright, uniform lighting.

1.9 PROJECT CONDITIONS

- A. Before commencing work, ensure environmental and site conditions are suitable for application and curing.
- B. Site Requirements
1. Application may proceed while air, material and substrate temperatures are between 60F and 85F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
 2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
 3. The Applicator shall ensure that adequate ventilation is available for the work area. This shall include the use of manufacturer's approved fans, smooth bore tubing and closure of the work area.
 4. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.
- C. Conditions of new concrete to be coated with cementitious urethane material.
1. Concrete shall be moisture cured for a minimum of 3 days and have fully cured a minimum of 5 days in accordance with ACI-308 prior to the application of the coating system pending moisture tests.
 2. Concrete shall have a flat rubbed finish, float or light steel trowel finish (a hard steel trowel finish is neither necessary nor desirable).
 3. Sealers and curing agents should not to be used.

4. Concrete shall have minimum design strength of 3.500 psi. and a maximum water/cement ratio of 0.45
5. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

D. Safety Requirements

1. All open flames and spark-producing equipment shall be removed from the work area prior to commencement of application.
2. "No Smoking" signs shall be posted at the entrances to the work area.
3. The Owner shall be responsible for the removal of foodstuffs from the work area.
4. Non-related personnel in the work area shall be kept to a minimum.

1.10 PROTECTION

- A. Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, cabinet work, equipment, etc. by suitable means.

1.11 WARRANTY

- A. See Section 017000 - Contract Closeout, for additional warranty requirements.
- B. Manufacturer warrants that material shipped to buyers at the time of shipment substantially free from material defects and will perform substantially to Dur-A-Flex, Inc. published literature if used in accordance with the latest prescribed procedures and prior to the
- C. expiration date.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
1. Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
1. Stonhard, 1000 East Park Avenue, Maple Shade, NJ 08052, 800.257.7953
 2. Flowcrete Americas, which is located at: 616 Spring Hill Dr. Suite 100; Spring, TX 77386; Tel: 936 539 6700; Fax: 936 539 6701; Web: www.flowcreteamericas.com.

- C. Substitutions: Refer to Section 016310 - Substitutions.

2.2 MATERIALS FLOORING:

- A. Type ERC1: Dur-A-Flex, Inc: Hybri-Flex EC (self-leveling chip broadcast), epoxy/aliphatic urethane topcoat seamless flooring system.
1. System Materials:
 - a. Topping: Dur-A-Flex, Inc, Poly-Crete SL resin, hardener and SL aggregate.
 - b. The broadcast aggregate shall be Dur-A-Flex, Inc. Q28 or Q11 quartz aggregate.
 - c. Broadcast: Dur-A-Flex, Inc. Dur-A-Glaze #4, epoxy based two-component resin.
 - d. Grout coats: Dur-A-Flex, Inc Dur-A-Glaze #4, epoxy-based, two-component resin.
 - e. Top coat: Dur-A-Flex, Inc. Armor Top aliphatic urethane 2 component resin with grit.
 2. Patch Materials
 - a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Poly-Crete MD (up to ¼ inch).
 - b. Deep Fill and Sloping Material (over ¼ inch): Use Dur-A-Flex, Inc. Poly-Crete WR.
 3. Cove Base - Type ERB1: Provide seamless high turned up coved base with 1" radius cove as indicated on drawings, for an integral seal at the joint between the floor and the wall.
 4. Color/Pattern: As indicated on drawings / finish schedule.
 5. Product Requirements:
 - a. Topping: Poly-Crete SL - 1/8" Thickness
 - 1) Percent Reactive: 100 %
 - 2) VOC: 0 g/L
 - 3) Bond Strength to Concrete ASTM D4541: 400 psi, substrates fails
 - 4) Compressive Strength, ASTM C579: 9,000 psi
 - 5) Tensile Strength, ASTM D638: 2,175 psi
 - 6) Flexural Strength, ASTM D790: 5,076 psi
 - 7) Impact Resistance @ 125 mils, MIL D-3134, 160 inch lbs
No visible damage or deterioration.
 - b. Broadcast Coat: Dur-A-Glaze #4 Resin
 - 1) Percent Reactive,: 100 %
 - 2) VOC: <4 g/L
 - 3) Water Absorption, ASTM D570: 0.04%
 - 4) Tensile Strength, ASTM D638: 4000 psi
 - 5) Coefficient of thermal expansion ASTM D696: 2×10^{-5} in/in/F
 - 6) Flammability ASTM D635: Self-Extinguishing.
 - 7) Flame Spread/ NFPA 101 ASTM E84: Class A
 - c. Topcoat: Armor Top
 - 1) VOC: 0 g/L
 - 2) 60 Degree Gloss ASTM D523: 75+/-5
 - 3) Mixed Viscosity, (Brookfield 25oC): 500 cps
 - 4) Tensile strength, ASTM D638; 7,000 psi
 - 5) Abrasion Resistance, ASTM D4060; Gloss Satin
CS 17 wheel (1,000 g load) 1,000 cycles: 4 8 mg loss w/ grit

		10	12 mg loss w/o grit
6)	Pot life @ 70° F 50% RH;	2 hours	
7)	Dry properties, 70°F, 50% RH:	8 hours tack free,	
		12 hours Dry	
	60°F, 30% RH:	12 hours tack free,	
		18 ours Dry	
	80°F, 70% RH:	4 hours tack free,	
		6 hours Dry	
8)	Flash Point PMCC:	186°F	
9)	Full Chemical resistance:	7 days	

2.3 MATERIALS WALLS

- A. Type: ERC3: Dur-A-Flex, Inc, Dur-A-Wall VC, epoxy-based, urethane topcoat, chip seamless wall system
- B. System Materials:
 - 1. Primer:C
 - a. Use the appropriate primer based on the substrate. Sheetrock finished to a level #5 will Require the use of Dur-A-Wall Gripper primer.
 - b. If substrate is block or CMU use the Dur-A-Wall Block Filler.
 - 2. Wall System
 - a. 1st Broadcast Coat: Dur-A-Flex, Inc, Dur-A-Gard No Sag resin and hardener.
 - b. 2nd Broadcast Coat: Dur-A-Flex, Inc, Dur-A-Glaze # 4 Water Clear resin and hardener.
 - c. Chips: Dur-A-Flex, Inc, decorative chips (Micro or Macro)
 - d. Grout Coat: Dur-A-Flex, Inc, Dur-A-Glaze #4 Water Clear resin and hardener.
 - e. Topcoats: Dur-A-Flex, Inc. Armor Top resin and hardener
 - 3. Patch Materials
 - a. Shallow Fill and Patching: Use Dur-A-Flex, Inc. Dur-A-Glaze #4 Cove Rez.
- C. Color: As indicated on drawings / finish schedule.
- D. Product Requirements:
 - 1. First Broadcast Coat Dur-A-Gard No Sag
 - a. Percent Solids 100 %
 - b. VOC 3.45 g/L
 - c. Compressive Strength, ASTM D695 16,000 psi
 - d. Tensile Strength, ASTM D638 3,800 psi
 - e. Flexural Strength, ASTM D790 4,000 psi
 - f. Abrasion Resistance, ASTM D4060
 - C-10 Wheel, 1,000 gm load, 1,000 cycles 35 mg loss
 - g. Flame Spread/NFPA-101, ASTM E84 Class A
 - h. Flammability, ASTM D635 Self Extinguishing
 - i. Impact Resistance MIL D-3134 0.025 inch Max
 - j. Water Absorption. MIL D-3134 0.04 %
 - k. Potlife @ 70 F 20-25 minutes
 - 2. Second Broadcast Coat and Grout Coat Dur-A-Glaze #4 Water Clear

a.	Percent Solids	100 %
b.	VOC	3.8 g/L
c.	Compressive Strength, ASTM D695	11,200 psi
d.	Tensile Strength, ASTM D638	2,100 psi
e.	Flexural Strength, ASTM D790	5,100 psi
f.	Abrasion Resistance, ASTM D4060	
	C-10 Wheel, 1,000 gm load, 1,000 cycles	29 mg loss
g.	Flame Spread/NFPA-101, ASTM E 84	Class A
h.	Impact Resistance MIL D-24613	0.0007 inches, no cracking or delamination
i.	Water Absorption. MIL D-24613	Nil
j.	Potlife @ 70 F	20 minutes
3.	Topcoats	Armor Top
a.	VOC	0 g/L
b.	60 Degree Gloss ASTM D523	75+/-5
c.	Mixed Viscosity, (Brookfield 25oC)	500 cps
d.	Tensile strength, ASTM D 638	7,000 psi
e.	Abrasion Resistance, ASTM D4060	Gloss Satin
	CS 17 wheel (1,000 g load)	4
	1,000 cycles	10 12 mg loss without grit
f.	Pot life @ 70° F 50% RH	2 hours
g.	Dry properties, 70°F, 50% R.H.	8 hours tack free, 12 hrs Dry
	60°F, 30% RH	2 hours tack free, 18 hours Dry
	80°F, 70%RH	4 hours tack free, 6 hours Dry
h.	Flash Point PMCC	186oF
i.	Full Chemical resistance	7 days

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.
- B. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 PREPARATION

- A. General
 1. New concrete surfaces shall be free of oil, grease, curing compounds, loose particles moss, algae growth, laitance, friable matter, dirt, and bituminous products.
- B. Moisture Testing: Perform tests recommended by manufacturer and as follows.
 1. Perform anhydrous calcium chloride test ASTM F1869. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 20 lbs/1,000 sf/24 hrs.

2. Perform relative humidity test using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
3. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.

3.3 FLOORING APPLICATION

A. General:

1. The system shall be applied in five distinct steps as listed below:
 - a. Substrate preparation
 - b. Topping/overlay application with chip broadcast.
 - c. Resin application with chip broadcast.
 - d. Topcoat application
 - e. Second topcoat application.
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Topping:

1. The topping shall be applied as a self-leveling system as specified by the Architect. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
4. The topping shall be applied over horizontal surfaces using 1/2 inch "v" notched squeegee, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a loop roller.
6. Chip aggregate shall be broadcast to excess into the wet resin, Macro chip at the rate of 0.1 lbs/sf and Micro chip at the rate of 0.15 lbs/sf.
7. Quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.8 lbs/sf.
8. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips and aggregate.

C. Broadcast

1. Dur-A-Glaze:
 - a. The broadcast coat resin shall be applied at the rate of 100 sf/gal.

- b. The broadcast coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
 - c. Chip aggregate shall be broadcast into the wet resin, Macro chips at the rate of 0.1 lbs/sf, Micro chips at the rate of 0.15 lbs/sf.
 - d. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose chips.
 - 2. Shop-Floor:
 - a. The broadcast coat resin shall be applied at the rate of 90 sf/gallon.
 - b. The broadcast coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
 - c. Aggregate shall be broadcast into the wet resin at the rate of 0.5 lbs/sf.
 - d. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.
- D. Grout Coat
 - 1. Dur-A-Glaze:
 - a. The grout coat shall be squeegee applied with a coverage rate of 100 sf/gal.
 - b. The topcoat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
 - c. The grout coat will be back rolled and cross rolled to provide a uniform texture and finish
 - 2. Shop-Floor
 - a. The grout coat shall be squeegee applied with a coverage rate of 90 sf/gal
 - b. The grout coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
 - c. The grout coat will be back rolled and cross rolled to provide a uniform texture and finish
- E. Topcoat:
 - 1. The first topcoat shall be squeegee applied with a coverage rate of 100 sf/gal.
 - 2. The topcoat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
 - 3. The first topcoat will be back rolled and cross rolled to provide a uniform texture and finish
 - 4. The second topcoat with grit shall be roller applied with a coverage rate of 500 sf/gal.
 - 5. The finish floor will have a nominal thickness of:
 - a. Hybri-Flex EB: 1/4 inch.
 - b. Hybri-Flex EC: 3/16 inch.
 - c.

3.4 WALL APPLICATION

- A. General:
 - 1. The system shall be applied in six distinct steps as listed below:

- a. Substrate preparation
 - 1) Priming
 - 2) Broadcast coats application with chip broadcast
 - 3) Second broadcast coat application with chip broadcast
 - 4) Grout coat application
 - 5) Topcoat applications
 2. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
 3. The system shall follow the contour of the substrate.
 4. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.
- B. Priming:
1. DUR-A-FLEX DUR-A-WALL HP BLOCK FILLER is recommended to fill any pores in the substrate when applying over concrete or block walls.
 2. When applying over sheet rock, use DUR-A-FLEX DUR-A-WALL HP GRIPPER PRIMER. This will prevent the base coat from soaking into the sheet rock.
- C. 1st Broadcast Coat:
1. The broadcast coat shall be comprised of the specified two components, a resin, and hardener.
 2. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means.
 3. The base coat shall be applied by a roller at the rate of 200 sf/gal to yield a dry film thickness of 8 mils.
 4. The chip will be broadcast into the wet resin at the rate of 0.1-0.12 lb/SF.
- D. 2nd Broadcast Coat:
1. A second broadcast coat will be applied as the first.
- E. Grout Coat:
1. The grout coat shall be comprised of the specified two components, a resin, and hardener.
 2. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means.
 3. The grout coat shall be applied using a roller at the rate of 200 sf/gal to yield a dry film thickness of 8 mils.

3.5 FIELD QUALITY CONTROL

- A. Tests, Inspection
1. The following tests shall be conducted by the Applicator:
 - a. Temperature
 - 1) Air, substrate temperatures and, if applicable, dew point.
 - b. Coverage Rates
 - 1) Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.6 CLEANING AND PROTECTION

- A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.
- B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION 096720

SECTION 096813 – ENTRY MAT CARPET TILE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Entry Mat Carpet tile, fully adhered.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Section 096500 - Resilient Wall Base and Accessories for resilient base, reducer strips, and other accessories installed with carpet.
- D. Section 096816 - Vinyl Backed Cushioned Carpet: Vinyl Backed Cushioned carpet.

1.3 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2019, with Editorial Revision (2020).
- B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- D. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.4 SUBMITTALS

- A. See Section 013000 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate layout of joints.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Testing: Verification elevator cab flooring meets ASTM E648 - Standard Test Method for Critical Radiant Flux Floor Covering Systems.
- H. Installer's Qualification Statement.
- I. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Material and Equipment, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed, but not less than 10 sq. yd.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum 10 years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum 5 years documented experience and approved by carpet tile manufacturer.

1.6 PROJECT CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Comply with CRI 104, Section 7.2, "Site Conditions? Temperature and Humidity" and Section 7.12, "Ventilation".
- C. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
 - 1. Modular Carpeting: Tandus Centiva, a Tarkett Company:
www.commercial.tarkett.com
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
- C. Substitutions: Not permitted.

2.2 ENTRY MAT TILE SYSTEM (WOT1)

- A. Product:.
 - 1. Provide Powerbond & Modular by Tandus (Tarkett):
 - 2. Style: Abrasive Action II – 02578
 - 3. Size: 18" x 18"
 - 4. Molded Reinforced Needlepunch Textile.
 - 5. Surface Texture: Rubber Reinforced Geometric Pattern
 - 6. Finished Pile Thickness: .250"
 - 7. Fiber System: 100% Premium Polypropylene
 - 8. Dye System: Solution dyed
 - 9. Backing Materials: Special Non-Thermoplastic Tri-Grip Cleated SBR
 - 10. Total Weight: 135 oz/yd
 - 11. Elevator cab flooring shall meet ASTM E648 - Standard Test Method for Critical Radiant Flux Floor Covering Systems.
- B. Color to be: As selected by Architect from manufacturer's full range.
- C. Pattern: Unidirectional. Confirm with Owner.

2.3 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Transition Strips: Refer to Section 096500 - Resilient Wall Base and Accessories.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 090561.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
 - 3. Follow moisture and alkalinity remediation procedures in Section 090561.
- E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 090561.

3.3 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION 096813

SECTION 096816 – VINYL BACKED CUSHIONED CARPET

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vinyl Backed Cushioned carpet.

1.2 RELATED SECTIONS:

- A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Section 096500 - Resilient Wall Base and Accessories for resilient base, reducer strips, and other accessories installed with carpet.
- D. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.3 REFERENCE STANDARDS

- A. ASTM C307 - 03(2012) Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing
- B. ASTM C531 - 00(2012) Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
- C. ASTM D635 - 10 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
- D. ASTM D2240 - 05(2010) Standard Test Method for Rubber Property-Durometer Hardness.
- E. ASTM D4060 - 10 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
- F. ASTM D4541 - 09e1 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2010.

- I. ASTM E1745 - 11 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- J. ASTM F1869 - 11 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- K. AATCC Test Method 147-2011 Antibacterial Activity Assessment of Textile Materials: Parallel Streak Method.
- L. UL 410 Standard for Safety for Slip Resistance of Floor Surface Materials.

1.4 SUBMITTALS

- A. See Section 013000 - Submittal Requirements for Submittal Procedures.
- B. 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 a minimum material specifications as listed in Section 2.2 (C).
- C. Contractor shall submit within ninety (90) 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.
- D. Seaming diagrams will not be required, but field seaming shall be discussed with and agreed to by the District representative prior to installation.
- E. 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.

1.5 QUALITY CONTROL

- A. All carpet shall be from the same dye lot. The Contractor shall provide carpet storage per manufacturer's recommendations between Phases.
- B. 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.
- C. The owner will award the bid with the understanding that the bids received were based upon the specified materials.
- D. 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.

- E. Installation must be performed by an installer that is approved by the manufacturer to coordinate with warranties offered by the manufacture.
- F. Manufacturer is required to notify Owner, Architect, and General Contractor if installation instructions are not completely followed.
- G. Manufacturer must have been in continual operation for a minimum of ten years.
- H. 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.

1.6 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.

1.9 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. 20 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 than 10% by weight from abrasion over a period of 20 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.
 - a. 20 Year non-prorated Adhesive Warranty: The Manufacturer warrants that the carpet will remain attached to the substrate for a period of twenty (20) years from the date of installation.
 - b. 20 Year non-prorated Edge Ravel Warranty: The Manufacturer warrants that the carpet will not have continuous ends coming out of lengthwise seams for a period of 20 years from the date of installation.
 - c. 20 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 (20) years from the date of installation.

- d. 20 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.
- e. 20 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 (20) years from the date of installation.
- f. 20 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.
- g. 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).
- h. Colorfastness to Atmospheric Contaminants Warranty: The Fiber Manufactures 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).

PART 2 - PRODUCTS

2.1 MANUFACTURER:

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
- B. Approved Carpet: Furnish carpet of one of the following, subject to meeting material, performance and warranty requirements of this Section.
 - 1. Tandus Centiva, a Tarkett Company: www.commercial.tarkett.com
- C. Substitutions: See Section 016310 - Substitutions.

2.2 VINYL BACKED CUSHIONED CARPET

- A. Tandus | Centiva Flooring: geometric patterned loop pile carpet with "Powerbond Cushion RS" backing; 16-ounce yard face weight minimum. Furnish in 6-foot-wide rolls with low VOC non-wet peel and stick adhesive installation.
 - 1. CPT1:
 - a. Style: 11644 Color Spectrum II
 - b. Color: To be Selected by Architect from full range
- B. The specifications for carpeting outlined below are for the purpose of establishing quality standards required under the contract. Only the manufacturers and products listed will be acceptable. There will be no evaluations of other products prior to bid, nor

will there 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.

C. 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.

D. Material Specifications:

1. Construction/Face Pattern:
 - a. Level Loop
 - b. 8.5 stitches per square inch
 - c. 13t° Gauge or higher
 - d. Primary Backing: Non-woven synthetic fiber
 - e. Width: 6 feet
 - f. Tuft Density: 108.8 tufts/sq inch
 - 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 Lumina Nylon
 - b. Face weight no greater than 22 oz. and no less than 16 oz
 - c. Dyed Method: Solution Dyed
3. Backing System:
 - a. Primary Backing: Synthetic Non-Woven
 - b. Secondary Backing: Powerbond Cushion RS
 - 1) Closed Cell Vinyl Cushion — ASTM D 1667; Min. 7 psi @ 25%; Max. 25 psi @ 25%
 - 2) Permanently fused to tufting blanket.
 - 3) No Moisture Penetration in field or seams after 10,000 Impacts.
 - 4) 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.

2.3 OTHER MATERIALS

- A. Transition Strips: Refer to Section 096500 - Resilient Wall Base and Accessories.
- B. 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 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 Flooring is installed, specifically peel-and-stick 6' wide rolls of Color Spectrum carpet, the contractor shall be responsible for contacting the following for a post-installation inspection by the carpet manufacturer:
- E. Tandus Flooring
- F. Mike Milhous, LEED AP e-mail: mmilhous@tandus.com
- G. or Lane, Loomis CA 95650
- H. Cell: (916) 806-8502 Fax: (916) 765-2839

END OF SECTION 096816

SECTION 098433 - SOUND-ABSORBING WALL UNITS

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 shop-fabricated, acoustical panel units tested for acoustical performance, including the following:
 - 1. Sound-absorbing wall panels.
- B. Related Requirements:

1.3 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For unit assembly and installation.
 - 1. Include plans, elevations, sections, and mounting devices and details.
 - 2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
 - 3. Include details at cutouts and penetrations for other work.
 - 4. Include direction of fabric weave and pattern matching.
- C. Samples for Verification: For the following products:
 - 1. Fabric: Full-width by approximately 36-inch- (900-mm-) long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
 - 2. Panel Edge: 12-inch- (300-mm-) long Sample(s) showing each edge profile, corner, and finish.
 - 3. Core Material: 12-inch- (300-mm-) square Sample at corner.
 - 4. Mounting Devices: Full-size Samples.
 - 5. Assembled Panels: Approximately 36 by 36 inches (900 by 900 mm), including joints and mounting methods.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Electrical outlets, switches, and thermostats.
 - 2. Items penetrating or covered by units including the following:
 - a. Alarms.
 - 3. Show operation of hinged and sliding components covered by or adjacent to units.
- B. Product Certificates: For each type of unit.
- C. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to the following:
 - a. Acoustical performance.

- b. Fabric sagging, distorting, or releasing from panel edge.
 - c. Warping of core.
- 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 SOUND-ABSORBING WALL UNITS

- A. Sound-Absorbing Wall Panel: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.
 - 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. Acoustical Solutions.
 - b. Armstrong Ceiling & Wall Solutions.
 - c. Decoustics; CertainTeed Architectural Products; a Saint Gobain company.
 - d. MBI Products Company, Inc.
 - e. Wenger Corporation.
 - 2. Panel Shape: Rectangular.
 - 3. Mounting: Back mounted with manufacturer's "Z" style metal clips or bar hangers, secured to substrate.
 - 4. Core: Manufacturer's standard.
 - a. Core-Face Layer: Manufacturer's standard.
 - 5. Edge Construction: Manufacturer's standard.
 - 6. Edge Profile: Chamfered (beveled).
 - 7. Corner Detail in Elevation: Square with continuous edge profile indicated.
 - 8. Facing Material: As selected by Architect from Manufacturers full range

9. Acoustical Performance: Sound absorption NRC of 1.10 according to ASTM C423 for mounting according to ASTM E795.
10. Nominal Core Thickness: 2 inches (51 mm).
11. Panel Width: As indicated on Drawings.
12. Panel Height: As indicated on Drawings.

2.4 MATERIALS

- A. Core Materials:
 1. Glass-Fiber Board: ASTM C612; of type standard with manufacturer; nominal density of 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m), unfaced, and dimensionally stable, molded rigid board; and with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- B. Facing Material: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.
- C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit, and as follows:
 1. Metal Clips or Bar Hangers: Manufacturer's standard two-part metal "Z" clips, with one part of each clip mechanically attached to back of unit and the other part to substrate, designed to permit unit removal.

2.5 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.
- B. Edge Hardening: For glass-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.
- C. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.
- D. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.
 1. Square Corners: Tailor corners.
 2. Radius and Other Nonsquare Corners: Attach facing material so there are no seams or gathering of material.
 3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent units.
- E. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:
 1. Thickness.
 2. Edge straightness.
 3. Overall length and width.

4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain [with adjacent units] [as indicated on Drawings].

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm) in 48 inches (1200 mm), noncumulative.

3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

SECTION 099113 - 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.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Galvanized metal.
- B. Do not paint or finish the following items:
 - 1. Items fully factory-finished unless specifically indicated. Materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes
 - 3. Items indicated to remain unfinished
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Natural stones.
 - 7. Floors, unless specifically so indicated.
 - 8. Glass.
 - 9. Concealed pipes, ducts, and conduits.
- C. Related Requirements:
 - 1. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit 4 paper “draw down” samples illustrating range of colors available for each finishing product specified.
2. Submit Samples on rigid backing, 8 inches square.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.
5. Samples shall be submitted at least 30 days prior to the start of painting work. Label and identify each sample as to location and application. Upon submittal of color samples, minor variations or changes in color selection may be requested by the Architect and new samples ordered until final color approval

D. 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. Indicate VOC content.
3. Product Characteristics.
4. Surface Preparation instructions and recommendations.
5. Primer Requirements and finish specification.
6. Storage and handling requirements and recommendations.
7. Application methods.
8. Cleanup information.
9. Manufacturer’s name, product name and/or catalog number, and general product category.
10. MPI product number
11. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.
 - a. Provide product equivalency table.

E. Product Certification: By manufacturer that all paints and coatings comply with VOC limits specified.

F. Product Certification: By manufacturer that all paints and coatings to not contain any of the prohibited chemicals specified; GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.

1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.**

1.5 MAINTENANCE MATERIAL SUBMITTAL

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.**

1. Paint: 1 gallon of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum 10 years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.
- C. Standards: Preparation, application and workmanship shall be in accordance with manufacturer's recommendations and applicable provisions of the following:
 1. Painting and Decorating Contractors of America (PDCA) "Painting Specification Manual and Standards"
 - a. PDCA P1-13: Touch-Up Painting and Damage Repair: Financial Responsibility and Definition of a Properly Painted Surface.
 - b. PDCA P2-13: Third Party Inspections: Qualifications, Responsibilities, and Procedures.
 - c. PDCA P3-13: Designation of Paint Color
 - d. PDCA P4-13: Responsibility for Inspection and Acceptance of Surfaces Prior to Painting and Decorating
 - e. PDCA P5-13: Benchmark Sample Procedures for Paint and Other Decorative Coating Systems.
 2. Gypsum Association ' CGA-232-04: "Painting New Gypsum Board".
- D. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 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.
- E. Lead containing materials of any type are unacceptable. All products shall be certified completely free of lead containing materials and submitted to WCSD for testing prior to any application.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.
 - 7. Application instructions.
- B. 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.

1.8 FIELD 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide [Sherwin-Williams Company \(The\)](#); products indicated or comparable product from one of the following:
 - 1. Benjamin Moore Corporation.
 - 2. PPG Architectural Finishes, Inc.
 - 3. Dunn-Edwards Corporation
- B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:
 - 1. Products are approved by manufacturer in writing for application specified.
 - 2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.

- C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
 - 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

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. VOC Content: For field applications, provide paints and coatings that complies with VOC content limits of authorities having jurisdiction.
- C. Colors: As indicated in a color schedule.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint 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 paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-site testing to verify compatibility, adhesion, and film integrity of new paint application.
 - 1. Report, in writing, conditions that may affect application, appearance, or performance of paint.

B. Substrate Conditions:

1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Fiber-Cement Board: 12 percent.
 - c. Masonry (Clay and CMU): 12 percent.
 - d. Wood: 15 percent.
 - e. Portland Cement Plaster: 12 percent.
 - f. Gypsum Board: 12 percent.
2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
3. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "Data Pages" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 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.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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 Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards.

- b. Uninsulated metal piping.
- c. Uninsulated plastic piping.
- d. Pipe hangers and supports.
- e. Metal conduit.
- f. Plastic conduit.
- g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 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.

3.6 EXTERIOR PAINTING SCHEDULE

- A. Ferrous Metal Fabrications:
 - 1. Waterbased/Alkyd Urethane System: over shop coat primer. Exposed Structural Steel, Lintels, Pipe Ballards.
 - a. Prime Coat: Primer, rust-inhibitive, water based: MPI 107
 - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
 - b. Intermediate Coat: Water-based acrylic-alkyd, exterior, matching topcoat.
 - c. Topcoat: Water-based alkyd-urethane, semi-gloss, exterior: MPI 169
 - 1) S-W Pro Industrial Waterbased Alkyd Urethane Semi-Gloss, B53-1150 Series, at 4.0 mils wet, 1.4 mils dry, per coat.
- B. Galvanized and Zinc Rich Metal Fabrications:
 - 1. Waterbased Light Industrial Acrylic System: over shop coat primer. Standard system for Hollow Metal Doors & Frames and miscellaneous flashing.
 - a. Prime Coat: Primer, rust-inhibitive, water based: MPI 107

- 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
- b. Intermediate Coat: Water-based Acrylic, exterior, matching topcoat.
- c. Topcoat: Water-based Acrylic, semi-gloss, exterior: MPI 163
 - 1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.

END OF SECTION 099113

SECTION 099123 - 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. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Galvanized metal.
 - 4. Aluminum (not anodized or otherwise coated).
 - 5. Gypsum board.
- B. Do not paint or finish the following items:
 - 1. Items fully factory-finished unless specifically indicated. Materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes
 - 3. Items indicated to remain unfinished
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Natural stones.
 - 7. Floors, unless specifically so indicated.
 - 8. Glass.
 - 9. Fully Concealed pipes, ducts, and conduits.
- C. Related Requirements:
 - 1. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit 4 paper "draw down" samples illustrating range of colors available for each finishing product specified.
 - 2. Submit Samples on rigid backing, 8 inches square.

3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
 5. Label each Sample for location and application area.
 6. Samples shall be submitted at least 30 days prior to the start of painting work. Label and identify each sample as to location and application. Upon submittal of color samples, minor variations or changes in color selection may be requested by the Architect and new samples ordered until final color approval
- D. 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. Indicate VOC content.
 3. Product Characteristics.
 4. Surface Preparation instructions and recommendations.
 5. Primer Requirements and finish specification.
 6. Storage and handling requirements and recommendations.
 7. Application methods.
 8. Cleanup information.
 9. Manufacturer's name, product name and/or catalog number, and general product category.
 10. MPI product number
 11. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.
 - a. Provide product equivalency table.
- 1.4 CLOSEOUT SUBMITTALS
1. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- 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. Paint: 1 gallon of each material and color applied.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum 10 years documented experience.
 - B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.
 - C. Standards: Preparation, application and workmanship shall be in accordance with manufacturer's recommendations and applicable provisions of the following:
 1. Painting and Decorating Contractors of America (PDCA) "Painting Specification Manual and Standards"

- a. PDCA P1-13: Touch-Up Painting and Damage Repair: Financial Responsibility and Definition of a Properly Painted Surface.
 - b. PDCA P2-13: Third Party Inspections: Qualifications, Responsibilities, and Procedures.
 - c. PDCA P3-13: Designation of Paint Color
 - d. PDCA P4-13: Responsibility for Inspection and Acceptance of Surfaces Prior to Painting and Decorating
 - e. PDCA P5-13: Benchmark Sample Procedures for Paint and Other Decorative Coating Systems.
2. Gypsum Association ‘ CGA-232-04: “Painting New Gypsum Board”.
- D. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 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.
- E. Lead containing materials of any time are unacceptable. All products shall be certified completely free of lead containing materials and submitted to WCSD for testing prior to any application.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer's label with the following information:
1. Product name and type (description).
 2. Batch date.
 3. Color number.
 4. VOC content.
 5. Environmental handling requirements.
 6. Surface preparation requirements.
 7. Application instructions.
- B. 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.

1.8 FIELD 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.
- C. Lead Paint: It is not expected that lead paint will be encountered in the Work.
 - 1. If suspected lead paint is encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide [Sherwin-Williams Company \(The\)](#); products indicated or comparable products from one of the following:
 - 1. Benjamin Moore Corporation.
 - 2. PPG Architectural Finishes, Inc.
 - 3. Dunn-Edwards Corporation
- B. Comparable Products: Comparable products of approved manufacturers will be considered in accordance with Section 016000 "Product Requirements," and the following:
 - 1. Products are approved by manufacturer in writing for application specified.
 - 2. Products meet performance and physical characteristics of basis of design product including published ratio of solids by volume, plus or minus two percent.
- C. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
 - 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

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. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall provide materials that comply with VOC limits of authorities having jurisdiction and for interior paints and coatings applied at Project site, the following VOC limits exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 100 g/L.

3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Wood Coatings: 275 g/L.

C. Colors: As indicated in a color schedule.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint 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 coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
 1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Gypsum Board: 12 percent.
 - e. Plaster: 12 percent.
 2. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
 3. Plaster Substrates: Verify that plaster is fully cured.
 4. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "Data Pages" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - 1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. 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.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

- K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 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.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- 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 Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work (Building A):
 - 1. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 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.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer sealer, latex, interior: MPI 3
 - 1) S-W Loxon Concrete & Masonry Primer Sealer, LX02W50, at 8.0 mils wet, 3.2 mils dry.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based, eggshell where indicated on drawings: MPI 151
 - 1) S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-1151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss where indicated on drawings: MPI 153
 - 1) S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-1151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
- B. Concrete Substrates, Traffic Surfaces:
 1. Concrete Stain System, MPI INT 3.2E:
 - a. First Coat: Stain, interior, for concrete floors, matching topcoat.
 - b. Topcoat: Stain, interior, for concrete floors, MPI #58.
 - 1) H & C Infusion
 - c. Provide Sealer, MPI INT 3.2G
 2. Water-Based Concrete Floor Sealer System, MPI INT 3.2G:
 - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
 - b. Topcoat: Sealer, water based, for concrete floors, MPI #99.
 - 1) H & C ClariShield Water-Based Wet Look Sealer
- C. CMU Substrates:
 1. Water-Based Light Industrial Coating System:

- a. Block Filler: Block filler, latex, interior/exterior: MPI 3
 - 1) S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
- b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
- c. Topcoat: Light industrial coating, interior, water based, eggshell where indicated on drawings: MPI 151
 - 1) S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-1151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
- d. Topcoat: Light industrial coating, interior, water based, semi-gloss where indicated on drawings: MPI 153
 - 1) S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K46-1151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
- D. Metal Substrates (Aluminum, Steel, Galvanized Steel):
 - 1. Waterbased Acrylic System: Standard system for doors & frames, misc metals.
 - a. Prime Coat: Primer, rust-inhibitive, water based: MPI 107
 - 1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
 - b. Intermediate Coat: Water-based Acrylic, interior, matching topcoat.
 - c. Topcoat: Water-based Acrylic, semi-gloss, interior: MPI 141
 - 1) S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
 - 2. Water-Based Dry-Fall System: Exposed Ceilings Exposed Ceiling Areas overhead metals
 - a. Top Coat: Dry-fall latex, flat: MPI 118
 - 1) S-W Pro Industrial Waterborne Acrylic Dryfall Flat, B42-181 Series, at 6.0 mils wet, 1.5 mils dry.
- E. Gypsum Board Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer sealer, latex, interior: MPI 149
 - 1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 wet, 1.0 mils dry.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based, eggshell where indicated on drawings: MPI 151
 - 1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-1151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss where indicated on drawings: MPI 153
 - 1) S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46-1151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Visual display board assemblies.

1.2 PREINSTALLATION REQUIREMENTS

- A. Locations:
 - 1. Confirm locations of all visual display boards with owner prior to installation.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Visual display board assemblies.
- B. Product Data Submittals: For each product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
- C. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For visual display units to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units 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.

1.8 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: 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:
 - a. Life of the building.

PART 2 - PRODUCTS

2.1 VISUAL DISPLAY BOARD ASSEMBLIES

- A. Visual Display Board Assemblies:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide MooreCo (formerly Best-Rite Manufacturing) or comparable product by one of the following:
 - a. ASI Visual Display Products.
 - b. Claridge Products and Equipment, Inc.
- B. Visual Display Board Assembly: F110
 - 1. MooreCo 202AH-25
 - 2. Assembly: Factory fabricated markerboard.
 - 3. Corners: Square.
 - 4. Width: 96 inches.
 - 5. Height: 48 inches.
 - 6. Mounting Method: Direct to wall.
- C. Visual Display Board Assembly: F111
 - 1. MooreCo Combination Board Type E: 404-60-PM-X2
 - 2. Assembly: Factory fabricated markerboard and tackboard.
 - 3. Corners: Square.
 - 4. Width: 48 inches.
 - 5. Height: 48 inches.
 - 6. Mounting Method: Direct to wall.
- D. Visual Display Board Assembly: F112
 - 1. MooreCo 302AG
 - 2. Assembly: Factory fabricated tackboard.
 - 3. Corners: Square.
 - 4. Width: 72 inches.
 - 5. Height: 48 inches.
 - 6. Mounting Method: Direct to wall.
- E. Visual Display Board Assembly: F113
 - 1. MooreCo 202AG-25
 - 2. Assembly: Factory fabricated markerboard.

3. Corners: Square.
 4. Width: 72 inches.
 5. Height: 48 inches.
 6. Mounting Method: Direct to wall.
- F. Visual Display Board Assembly: F123
1. MooreCo 202AD-25
 2. Assembly: Factory fabricated markerboard.
 3. Corners: Square.
 4. Width: 48 inches.
 5. Height: 48 inches.
 6. Mounting Method: Direct to wall.
- G. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
1. Color: White.
- H. Tackboard Panel: Natural-cork tackboard panel on core indicated.
1. Color and Pattern: As selected by Architect from manufacturers full range.
- I. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape.
1. Aluminum Finish: Clear anodic finish.
- J. Combination Assemblies: Provide manufacturer's standard exposed trim between abutting sections of visual display panels.
- K. Chalktray: Manufacturer's standard; continuous.
1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.
 2. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
- L. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
1. Size: 1 inch (25 mm) high by full length of visual display unit.
 2. Tackboard Insert Color: As selected by Architect from manufacturers full range.
 3. Aluminum Color: Match finish of visual display assembly trim.

2.2 MARKERBOARD PANELS

- A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with high-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
1. Face Sheet Thickness: 0.021 inch (0.53 mm) uncoated base metal thickness.
 2. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
 3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.3 TACKBOARD PANELS

- A. Tackboard Panels:
 - 1. Facing:
 - a. 1/8-inch- (3-mm-) thick, natural cork.
 - 2. Core:
 - a. Manufacturer's standard.
 - b. 3/8-inch- (9.5-mm-) thick fiberboard.

2.4 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
- B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish.
- C. Hardboard: ANSI A135.4, tempered.
- D. Particleboard: ANSI A208.1, Grade M-1.
- E. MDF: ANSI A208.2, Grade 130.
- F. Fiberboard: ASTM C208 cellulosic fiber insulating board.
- G. Extruded Aluminum: ASTM B221 (ASTM B221M), Alloy 6063.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA AMP 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.

2.6 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 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 roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display units.
- D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install visual display surfaces 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.
- B. Factory-Fabricated Visual Display Board Assemblies:
 - 1. Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.
- C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.
 - 1. Mounting Height: 36 inches (914 mm) above finished floor to top of chalktray.

3.3 CLEANING AND PROTECTION

- A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 101400 – SIGNAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. All graphics and signage for the Project
 - 1. Room and door signs.
 - 2. Interior directional and informational signs.
- B. Building identification signs.
- C. Plaques.

1.2 RELATED REQUIREMENTS

- A. Section 220553 - Identification for Plumbing Piping and Equipment.
- B. Section 260553 - Identification for Electrical Systems.

1.3 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4 MINIMUM SIGN REQUIREMENTS

- A. Permanent Rooms and Spaces:
 - 1. Tactile and Braille Characters, raised minimum 0.793 mm (1/32 in). Characters shall be accompanied by Grade 2 Braille.
 - 2. Type Styles: Characters shall be uppercase, Helvetica Medium, Helvetica Medium Condensed and Helvetica Regular.
 - 3. Character Height: Minimum 16 mm (5/8 in) high, Maximum 50 mm (2 in).
 - 4. Symbols (Pictograms): Equivalent written description shall be placed directly below symbol, outside of symbol's background field. Border dimensions of symbol background shall be minimum 150 mm (6 in) high.
 - 5. Finish and Contrast: Characters and background shall be eggshell, matte or other non-glare finish with adequate contrast with background.
 - 6. Mounting Location and Height: As shown in drawings, mounted on wall adjacent to the latch side of the door and to avoid door swing and protruding objects.
- B. Overhead Signs:

1. Type Styles: As shown. Characters shall have a width-to-height ratio between 3:5 and 1:1. Characters shall have a stroke width-to-height ratio of between 1:5 and 1:10.
2. Character Height: minimum 75 mm (3 in) high for overhead signs. As shown, for directional signs.
3. Finish and Contrast: Same as for signs of permanent rooms and spaces.
4. Mounting Location and Height: As shown in Drawings.

1.5 SUBMITTALS

- A. See Section 013000 - Submittal Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Shop Drawings: Show fabrication and installation details for signs.
 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- E. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- F. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- G. Verification Samples: Submit samples showing colors specified.
- H. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- I. Closeout Submittals:
 1. Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.
 2. Submit warranty documents specified herein.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 10 years of documented experience.
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1.7 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.9 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

1.10 WARRANTY

- A. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.
 - 1. Warranty Period: One (1) year from Substantial Completion date.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Signs of type, size and design shown on the drawings and as specified.
- B. Signs complete with lettering, framing and related components for a complete installation.
- C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.
- D. Do not scale drawings for dimensions. Contractor to verify and be responsible for all dimensions and conditions shown by these drawings. Resident Engineer to be notified of any discrepancy in drawing, in field directions or conditions, and/or of any changes required for all such construction details.

- E. The Sign Contractor, by commencing work of this section, assumes overall responsibility, as part of his warranty of work, to assure that assemblies, components and parts shown or required within the work of the section, comply with the Contract Documents. The Contractor shall further warrant: That all components, specified or required to satisfactorily complete the installation are compatible with each other and with conditions of installations.

2.2 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. Sign Type: Flat signs with laminated panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Character Height: As indicated on Drawings.
- C. Interior Directional and Informational Signs:
 - 1. Sign Type: Same as room and door signs.
 - 2. Sizes: As indicated on drawings.
 - 3. Wording of signs is scheduled on drawings.
 - 4. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.
- D. Building Identification Signs:
 - 1. Use individual metal letters.
 - 2. Mount on outside wall in location indicated on drawings.
- E. Fire Extinguisher Cabinets: Cabinets and enclosed compartments used to house portable fire extinguishers shall be clearly marked with the words FIRE EXTINGUISHER in letters at least 2 inches (51 mm) high.
 - 1. Identify extinguishers and cabinets with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface
- F. Traffic Signs: To match campus standards; locate where indicated on drawings.

2.3 PANEL SIGNS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products to be incorporated into the Work include the following:
 - 1. Approved Manufacturers:
 - a. ACE Sign Systems, Inc.
 - b. APCO Graphics, Inc.
 - c. ASI-Modulex, Inc.
 - d. Best Sign Systems Inc.
 - e. Nelson-Harkins Industries.
 - 2. Substitutions: Refer to Section 016310 - Substitutions.

- B. Laminated Interior Signs: Contrasting Melamine plastic laminate.
 - 1. Surface Finish: Mat.
 - 2. Edge Condition: Beveled.
 - 3. Corner Condition: Square.
 - 4. Thickness: ¼ inch.
- C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1.
 - 1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed Or rounded shape.
 - a. Panel Material: Opaque acrylic sheet.
 - b. Raised-Copy Thickness: Not less than 1/32 inch.

2.4 DIMENSIONAL LETTERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Series LF as manufactured by ASI Modulex, Inc. or a comparable product by one of the following:
 - 1. Approved Manufacturers:
 - a. ACE Sign Systems, Inc.
 - b. Advance Corporation; Braille-Tac Division.
 - c. A. R. K. Ramos.
 - d. Bunting Graphics, Inc.
 - e. Charleston Industries, Inc.
 - f. Gemini Incorporated.
 - g. Grimco, Inc.
 - h. Innerface Sign Systems, Inc.
 - i. Metal Arts; Div. of L&H Mfg. Co.
 - j. Mills Manufacturing Company.
 - k. Mohawk Sign Systems.
 - l. Nelson-Harkins Industries.
 - m. Signature Signs, Incorporated.
 - 2. Substitutions: Refer to Section 016310 - Substitutions.
- B. Fabricated Channel Characters: Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with the following requirements:
 - 1. Aluminum Sheet: Not less than 0.125 inch thick for face and 0.125 inch thick for returns.
 - a. Finish: Brushed aluminum.
 - b. Font: As indicated on Drawings.
- C. Exterior Signage: As indicated on drawings.

2.5 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

- B. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- C. Exposed Screws: Stainless steel.
- D. Tape Adhesive: Double sided tape, permanent adhesive.

2.6 FABRICATION

- A. General Provide manufacturer's standard signs of configurations indicated.
 - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
 - 2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
 - 3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
 - 4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

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 work.
- B. Verify that items, including anchor inserts, and electrical power are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected
- D. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.
- E. Wall mount plaques shall be installed straight, level and true to the surface of the mounting area. The plaque shall be mounted in accordance with manufacturer's specification with concealed fasteners for the type of wall surface that the plaque is

being mounted. Plaques shall be mounted so that the center of the plaque is located in five (5) feet above the finish grade or floor.

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces per manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 102113.17 – PHENOLIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Phenolic toilet and shower compartments.
- B. Urinal and vestibule screens.

1.2 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications: Concealed steel support members. Sheet metal backing for wall mounted partitions.
- B. Section 102800 - Toilet Room Accessories.

1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- D. ICC A117.1-2009 - Accessible and Usable Buildings and Facilities; 2009.
 - 1. as applicable to toilet compartments designated as accessible.
- E. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.5 SUBMITTALS

- A. See Section 013000 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories. Include fabrication details, description of materials and finishes.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings. Include choice of options with details.
- D. Samples: Submit two samples of partition panels, 6 x 6 inch in size illustrating panel finish, color, and sheen.

- E. Manufacturer's Installation Instructions: Indicate special procedures.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 10 years experience in the manufacture of toilet compartments.
- B. Installers Qualifications: Experienced Installer regularly engaged in installation of toilet compartments for minimum 58 years.
- C. Source Limitations: Obtain toilet compartment components and accessories from single manufacturer.
- D. Accessibility Requirements: Comply with requirements of ICC/ANSI 117.1, and with requirements of authorities having jurisdiction.
- E. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 30.
 - 2. Smoke-Developed Index: 110.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver toilet compartments to site until building is enclosed and HVAC systems are in operation.
 - 1. Deliver toilet compartments in manufacturer's original packaging.
 - 2. Store in an upright condition.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship during the following period after substantial completion:
 - 1. Phenolic Core Toilet Partitions: Against delamination: 3 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of Bradley Corporation, Mills Metals Division, Menomonee Falls, WI 53051.
 - 1. Contact Information:
(800)272-3539, fax (262)251-5817; Email info@BradleyCorp.com;
Website: www.bradleycorp.com.
- B. Acceptable Manufacturers:
 - 1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
 - 2. Partition Systems International of South Carolina; Phenolic Toilet Partitions: www.psisc.com/#sle.
 - 3. Or Approved Equal.

C. Substitutions: Section 016310 - Substitutions.

2.2 PHENOLIC TOILET / SHOWER COMPARTMENTS / URINAL SCREENS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels.

1. Basis of Design Product: Bradley, Mills Partitions, Model: Floor-to-Ceiling Braced, Series 700.
2. Phenolic Core: Compressed cellulose impregnated with phenolic resins. Provide smooth material, without creases or ripples.
3. Door, Panel, and Pilaster Construction, General: Form edges with 15 degree bevel without crown molding. Finish edges smooth.
4. Mounting: Floor-mounted, ceiling braced.
5. Color: As selected by Architect from manufacturer's full range of Standard colors.

B. Doors:

1. Thickness: 3/4 inch.
2. Width: Toilet Partition: 26 inch.; Shower Partition: 26 inch
3. Width for Handicapped Use: 36 inch, out-swinging doors with a minimum 32-inch(813-mm-) wide clear opening for compartments designated as accessible.
4. Height: 72 inch. ; 69 inch. tall doors at ADA stalls.

C. Panels:

1. Thickness: 1/2 inch.
2. Height: As indicated on Drawings.
3. Depth: As indicated on Drawings.
4. Mounting Height: 6" AFF; panels mounted 9" AFF for ADA stalls.

D. Pilasters:

1. Thickness: 3/4 inch.
2. Width: As required to fit space; minimum 3 inch.
3. Provide pilaster with mechanically fastened leveling bar reinforcement with zinc-plated jack bolt for leveling.

~~E. Shower Compartments: with doors; to match compartments.~~ **Shower Compartments: refer to other specification sections (framed walls with epoxy resinous coating on floors and full height walls**

- ~~1. Thickness: 1/2 inch.~~
- ~~2. Height: As indicated on Drawings.~~
- ~~3. Depth: As indicated on Drawings~~

F. Urinal Screens: without doors; to match compartments.

1. Wall hung with panel brackets:
 - a. Basis of Design Product: Bradley, Mills Partitions, Model No. 2.
2. Thickness: 1/2 inch.
3. Height: 48 inch.
4. Depth: As indicated on Drawings
5. Mounting:
 - a. Three cast stainless steel stirrup brackets.
 - b. Two-ear stainless steel or Aluminum continuous brackets.
6. Mounting Height: 18" AFF.

2.3 FABRICATION

- A. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

2.4 ACCESSORIES

- A. Headrail: Extruded anodized aluminum headrail with anti-grip profile. Provide clamps for attachment to pilaster and stainless steel brackets to secure to wall.
- B. Wall and Pilaster Brackets: Satin stainless steel; manufacturer's standard type for conditions indicated on drawings.
- C. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- D. Hardware - Heavy Duty: Manufacturer's heavy-duty stainless steel castings, including stainless steel tamper-resistant fasteners:
 - 1. Hinges: Self-closing surface mounted, through bolted, with gravity cams, adjustable to hold doors open at any angle up to 90 degrees, with emergency access by lifting door. Mount with stainless steel through-bolts.
 - 2. Latch and Keeper: Surface-mounted slide latch with flat rubber-faced combination door strike and keeper, with provision for emergency access, meeting requirements for accessibility at accessible compartments.
 - 3. Coat Hook: Combination hook and rubber-tipped stop, sized to prevent door from hitting compartment-mounted accessories. Provide wall bumper where door abuts wall. Provide formed L-shaped hook without stop at outswing doors. Mount with stainless steel through-bolts.
 - 4. Door Pull: Standard unit on outside of inswing doors. Provide pulls on both sides of outswing doors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Clearances: Install with clearances indicated on Drawings. Where clearances are not indicated, allow maximum 1/2 inch (13 mm) between pilasters and panels, and 1 inch (25 mm) between panels and walls.

- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

3.5 FINAL CLEANING

- A. Remove packaging and construction debris and legally dispose of off-site.
- B. Clean partition and screen surfaces with materials and cleansers in accordance with manufacturer's recommendations.

END OF SECTION **102113.17**

SECTION 102800 – TOILET ROOM ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Utility room accessories.

1.2 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealant around grab bars and accessories.
- B. Section 092216 - Non-Structural Metal Framing Sheet metal backing for accessories.

1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017.
- G. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- I. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.
- J. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004, with Editorial Revision (2016).
- K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.5 SUBMITTALS

- A. See Section 013000 - Submittal Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

1.7 WARRANTY

- A. See Section 017000 - Contract Closeout, for additional warranty requirements.
- B. Manufacturer's Warranty for Washroom Accessories: Manufacturer's standard 1 year warranty for materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Refer to Drawings - Toilet Accessory Schedule and Interior Elevations.
- B. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept Expressed in Contract Documents is not changed, as determined by the Architect.
 - 1. Basis of Design: Bobrick Washroom Equipment, Inc..
- C. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
 - 1. American Specialties, Inc: www.americanspecialties.com.
 - 2. Bradley Corporation: www.bradleycorp.com.
- D. Substitutions: Section 016310 - Substitutions.
- E. Provide products of each category type by single manufacturer.

2.2 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide 6 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- E. Back paint components where contact is made with building finishes to prevent electrolysis.

2.4 COMMERCIAL TOILET ACCESSORIES

- A. Refer to Drawings - Toilet Accessory Schedule and Interior Elevations.
- B. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Refer also to Section 088300 - Mirrors.

2.5 UTILITY ROOM ACCESSORIES

- A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
 - 1. Holders: Three spring-loaded rubber cam holders.
 - 2. Length: 36 inches.
- B. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
 - 1. Drying rod: Stainless steel, 1/4 inch diameter.
 - 2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: 36 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.
- E. See Sections 055000 or 092216 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate in locations and at heights indicated on Drawings.
- C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.

3.4 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.

3.5 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 102800

SECTION 104400 – FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.2 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- B. FM (AG) - FM Approval Guide; current edition.
- C. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).
- D. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

- A. See Section 013300 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Size: 6 by 6 inches (150 by 150 mm) square.
- E. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.5 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Basis of Design: Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpq.com/#sle.
 - 2. Ansul, a Tyco Business: www.ansul.com.
 - 3. Potter-Roemer: www.potterroemer.com.
 - 4. Pyro-Chem, a Tyco Business: www.pyrochem.com.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Basis of Design: Activar Construction Products Group, Inc. - JL Industries: www.activarcpq.com/#sle.
 - 2. Larsen's Manufacturing Co: www.larsensmfg.com.
 - 3. Potter-Roemer: www.potterroemer.com.
- C. Substitutions: See Section 016310 - Substitutions.

2.2 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
 - 2. Monoammonium phosphate-based dry chemical.
 - 3. Finish: Baked polyester powder coat, red color.
 - 4. Valves: Manufacturer's standard.
 - 5. Handles and Levers: Manufacturer's standard.
 - 6. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
 - 7. Temperature range: Minus 40 degrees F to 120 degrees F.

- C. Class: 2A:
 - 1. Cosmic 5E; 3-A:40-B:C
 - 2. Size: 5 pound.
 - 3. Bracket (in Shops – Building B): MB818C
 - 4. Cabinet (Building A): FEC-1
 - 5. Cabinet (Exterior): FEC-2

- D. Class: 3A:
 - 1. Cosmic 5E; 3-A:40-B:C
 - 2. Size: 5 pound.
 - 3. Bracket (in Shops – Building B): MB818C

- E. Class: 10A (Fueling Area):
 - 1. Cosmic 20E; 10-A:120-B:C
 - 2. Size: 20 pound.

2.3 FIRE EXTINGUISHER CABINETS – (JR INDUSTRIES)

- A. Type FEC-1 (Interior, Building A stud walls): Cabinet Configuration: Semi-recessed type.
 - 1. Basis of Design: Ambassador Series.
 - 2. Door Style: Style V: Vertical Duo Panel; narrow vertical glazing full height of door; with pull handle.
 - 3. Trim Style and Depth: Semi-recessed Cabinet:
 - a. Rolled Edge: 2-1/2 inch (63.50 mm), as required for specified extinguisher.
 - 4. Door and Trim Construction: Stainless steel; flush doors with 5/8 inch (15.88mm) door stop attached by continuous hinge and equipped with zinc-plated handle with roller catch.
 - a. Finish:
 - 1) Standard Color: White.
 - b. Finish of Cabinet Interior: White enamel.
 - 5. Door Glazing: Type 17: Clear tempered glass
 - 6. Cabinet Mounting Hardware: Pre-drill for anchors.
 - 7. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide ADA flush door pull and friction latch.
 - b. Provide manufacturer's standard hinge permitting door to open 180 degrees.
 - 8. Weld, fill, and grind components smooth.
- B. Type FEC-2 (Exterior): Cabinet Configuration: Surface mount type.
 - 1. Basis of Design: Ambassador Series.
 - 2. Door Style: Style V: Vertical Duo Panel; narrow vertical glazing full height of door; with pull handle.
 - 3. Trim Style and Depth: Surface Mount Cabinet with Rolled Edge:
 - 4. Door and Trim Construction: Stainless steel; flush doors with 5/8 inch (15.88mm) door stop attached by continuous hinge and equipped with zinc-plated handle with roller catch.
 - a. Finish:
 - 1) Standard Color: Red
 - b. Finish of Cabinet Interior: Red enamel.

5. Door Glazing: Type 10: Clear acrylic
 6. Cabinet Mounting Hardware: Pre-drill for anchors.
 7. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - a. Provide ADA flush door pull and friction latch.
 - b. Provide manufacturer's standard hinge permitting door to open 180 degrees.
 8. Weld, fill, and grind components smooth.
- C. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E814 for fire-resistance rating of wall where it is installed. Construct fire-rated cabinets with double walls fabricated from 0.0478 inch (1.2-mm) thick, cold-rolled steel sheet lined with minimum (16-mm) thick, fire-barrier material. Provide factory drilled mounting holes.

2.4 ACCESSORIES

- A. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
- B. Door Lock: Cylinder lock, keyed alike to other cabinets.
- C. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
 1. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - a. Location: Applied to cabinet door.
 - b. Application Process: Pressure-sensitive vinyl letters.
 - c. Lettering Color: Red.
 - d. Orientation: Vertical.
- D. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level, 60 inches from finished floor to the top of the extinguisher, or as indicated on Drawings.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.
- E. Wall Signs:

1. Location: Where shown or directed.
2. Apply on walls after field painting is completed and has been accepted.

F. Position cabinet signage as indicated.

3.3 MAINTENANCE – SELF-SERVICE FIRE EXTINGUISHERS

- A. Annual Inspections: Inspect self-service fire extinguishers on annual basis in accordance with manufacturer's instructions, and requirements of the authorities having jurisdiction (AHJ).
- B. Inspection Certification Tag: Provide new tag indicating acceptable condition of fire extinguisher, date of inspection, and name of self-service inspector for each inspection.

END OF SECTION **104400**

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Knocked-down athletic lockers.
 - 2. Locker benches.

1.2 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 metal locker.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- D. Samples for Verification: For the following products, in manufacturer's standard size:
 - 1. Lockers and equipment.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms 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. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:
 - a. Locks.
 - b. Hooks.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

- B. Deliver master and control keys to Owner by registered mail or overnight package service.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

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 metal lockers can be supported and installed as indicated.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.
 - 1. Obtain locks from single lock manufacturer.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide DeBourgh Manufacturing Company, Apex Athletic Lockers or comparable product by one of the following:
 - 1. Wenger Corporation
 - 2. Or Approved Equal

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.3 WELDED ATHLETIC LOCKERS, F122

- A. Locker Construction
 - 1. Lockers to be welded at seams and joints with exposed welds sanded smooth.
 - 2. No bolts, screws or rivets to be used in assembly of locker units.

3. Ship lockers set-up, ready to be anchored in place in accordance with manufacturer's instructions.
- B. Body of Lockers
1. Sides and Intermediate Partitions: Constructed of 1-inch by 1-inch by 1/8-inch steel angle iron frame with either 16-gauge diamond perforated sheet steel or 13-gauge bond sheared, flattened expanded metal welded to steel angle frames. Formed sheet steel locker frames are not acceptable.
 2. Exposed End Panels: Constructed of 1-inch by 1-inch by 1/8-inch steel angle iron frame with 16-gauge sheet steel welded to steel angle frame.
 3. Backs: Solid sheet of 18 gauge cold rolled sheet steel welded to frames of sides and intermediate partitions.
 4. Shelves and Tier Dividers: Constructed of 16 gauge cold rolled sheet steel welded to side and intermediate partition construction. Shelves provided in lockers 48-inches and taller, located to provide a minimum of 12-inches clearance.
- C. Doors
1. 14 gauge formed doors constructed of single piece cold rolled steel with double bends on vertical sides and a single bend on horizontal sides
 - a. An additional 13-gauge steel handle panel with 16 gauge cold rolled steel back panel will be securely welded to the center span of the door. All horizontal mesh edges shall be concealed with an additional steel formation welded to the door.
 2. Perforation: As selected by Owner from:
 - a. Diamond perforated , or
 - b. Secur-N-Vent – three-dimensional vertical vents formed on fronts and backs of door.
- D. Latching
1. Sentry I Three-Point/Three-Sided Cremone Latch
 - a. Latching mechanism operated by a steel handle welded to a three-point cremone type assembly.
 - b. Latching rods, 3/8-inch diameter, engage top and bottom edge of locker frame. A 3/16-inch thick center latch engages door jamb.
- E. Hinges
1. Hinges to be 3-inch, five knuckle, 14-gauge heavy-duty fast pin welded to both door and frame.
 2. Locker doors 42-inches high or less shall have 2 hinges.
 3. Doors over 42-inches shall have 3 hinges.
- F. Slope Tops
1. Provide 18 gauge all welded slope top with 25-degree pitch, attached at factory with concealed fasteners. Slope top to be in addition to the standard 16-gauge flat top.
- G. Filler Panels: Manufacturer's standard fabricated from 18-gauge solid steel finished to match lockers. Provide slip joint fillers angle formed to receive filler panel.
- H. Finish

1. Complete locker unit to be thoroughly cleaned, phosphatized and sealed.
2. Finish to be baked powder coat with a minimum 2-3 mil thickness.
3. Color of lockers shall be chosen from manufacturer's standard colors.

2.4 LOCKER ACCESSORIES

- A. A.Interior Equipment: Furnish each locker with the following items, unless otherwise indicated.
1. Hooks
 - a. Hooks to be heavy-duty forged steel with ball ends and zinc plated.
 - b. Provide two single ceiling hooks and one double ceiling hook in each locker opening 20-inches or taller.
 2. Numbering
 - a. Finish each locker with black anodized laser etched aluminum number plate.
 - b. Locate number plate near center of each door.
 - c. Owner to furnish numbering sequence.
 3. Coat Rods: Manufacturer's standard zinc plated. Optional clothes rod in lieu of ceiling hook available (recommended for lockers 18-inches deep or greater).

2.5 BENCHES

- A. A.Bench tops to be made of butcher block, Mixed Hardwood 1-1/4-inches thick. Apply double coat of satin-gloss sealer for protection.
- B. Dimensions
1. F124: 22 to 24 inches wide by 42 inches long.
 2. F125: 18 inches wide by 84 inches long.
- C. B.Pedestals
1. Heavy Duty Pedestals: Heavy duty cast iron bell shaped base with a diameter of 7-3/4-inches threaded for 1-1/2-inch pipe. The pedestal is secured to the floor with a 1/2-inch by 5-1/2-inch concealed concrete anchor. Overall pedestal height is 16-inches. Misty Gray powder coat is standard, with optional standard color choice available.

2.6 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
- A. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.
- B. Accessible Lockers: Fabricate as follows:
 1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
 2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- C. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- D. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

2.7 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.
 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
 2. Provide toothed-steel or expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- 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. Install lockers level, plumb, and true; shim as required, using concealed shims.
 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 2. Anchor single rows of metal lockers to walls near top and bottom of lockers.

3. Anchor back-to-back metal lockers to floor.
 - A. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.
 - B. Equipment:
 1. Attach hooks with at least two fasteners.
 2. Attach door locks on doors using security-type fasteners.
 3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
 - b. Attach plates to upper shelf of each open-front metal locker, centered, with at least two aluminum rivets.
 - C. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
 1. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
 2. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.
 - D. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches (1830 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.
- 3.3 ADJUSTING
- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.
- 3.4 PROTECTION
- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
 - B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 107113 - EXTERIOR SUN CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

- A. This section includes products to assist in controlling the effects of the sun.
 - 1. Horizontal sunshades
 - 2. Vertical sunshades
- B. Related work specified elsewhere
 - 1. 085113 Exterior Aluminum Windows
 - 2. 055000 Metal Fabrications
 - 3. 042200 Concrete Unit Masonry
 - 4. 107300 Aluminum Canopies
- C. Work included in this section.
 - 1. The extent of the extruded aluminum sunshade system is shown on the contract drawings and hereby defined to include all sunshade devices of the type shown and specified herein.

1.2 INDUSTRY STANDARD

- A. Reference:
 - A. Products and executions are specified in this section by reference to the following industry and/or trade specifications or standards of the following:
 - B. National Association of Architectural Metal Manufacturers (NAAMM), the Aluminum Association (AA), American Architectural Manufacturers Association (AAMA).

1.3 QUALIFICATIONS

- A. Manufacturers:
 - 1. Basis of Design:
 - 2. For the purpose of designation type and quality for the work under this section, drawings and specifications are based on the products manufactured by Architectural Grilles and Sunshades, Inc. (AGS, Inc.); 22442, Fey Drive, Frankfort, IL 60448. Phone: (708) 479-9458, Fax: (708) 479-9478. Email: Nathan.s@agsshade.com
 - 3. Additional Acceptable Manufacturers:
 - 4. Subject to compliance with these specifications, products as manufactured by:
 - i. Pittco Architectural Metals
 - ii. MASA Architectural Canopies
 - iii. Construction Specialties, Inc.
 - b. Substitutions: See Section 016310 - Substitutions.

- B. Minor adjustments may be made in interest of fabrication or installation methods, techniques, or ability to satisfy concept expressed in Contract Documents, provided concept is maintained as determined by Owner and Architect.

1.4 SUBMITTALS:

- A. Product data: Manufacturers technical and descriptive data.
- C. Shop Drawings:
 - 1. Submit for architect's approval prior to commencement of any work or fabrication under this section, 1 set of detail shop drawings showing all areas of work profiles and sections of all components, finishes and fastening details.
- D. Warranties:
 - 1. The work in this section shall be guaranteed against defects in material and workmanship for a period of one (1) year from date of acceptance of the building. Contractor shall replace and repair any defects at no cost to the owner.

1.5 COMPONENTS:

- A. Shipping and Handling:
 - 1. Deliver materials to the job site ready for erection. Assembled units to be packaged and shipped to prevent damage during freight and storage on site.

PART 2 PRODUCTS

2.1 MATERIALS:

- A. General: Metal shall be free from defects impairing strength, durability, or appearance.
 - 1. Aluminum – ASTM B 221, alloys 6063-T5 and 6063-T6 for extrusions. ASTM B 209, alloys 5052-H32 or greater.
 - 2. Fasteners – Unless otherwise noted, fasteners shall be 300 series non-magnetic stainless steel. ASTM A-307, grade A or better.

2.2 HORIZONTAL SUNSHADES

- A. Components:
 - 1. Outriggers: 1/4" thick by 8" tall extruded aluminum flat plate.
 - 2. Blades: 2" x 6" high, extruded aluminum rectangular tube design.
 - 3. Fascia: 2" x 8" extruded aluminum rectangular tube.
 - 4. Mounting Bracket: Manufacturer's standard for configuration.

5. Dimensions: As indicated on drawings.

B. Components to be shop assembled in as large as practical sections– to allow for immediate erection.

2.3 VERTICAL SUNSHADES:

A. Style: Stanley Series, ~~Tampa~~ **Nashville**

B. Components:

1. Vertical Fins: ~~3/8"~~ **1/8"** thick extruded aluminum flat plate **with 1/4" perforations on 3/8" staggered centers. Perimeter 2-1/2" square tubes.**

2. Mounting Bracket: Manufacturer's standard for configuration.

3. Dimensions: As indicated on drawings.

C. Components to be shop assembled in as large as practical sections– to allow for immediate erection.

2.4 ALUMINUM FINISH:

A. General:

B. Finish on exposed aluminum shall be compliant with the performance standards set forth in AAMA Specifications 2605-98, "Superior Performing Organic Coatings on Aluminum."

C. Type:

D. Factory-applied, high performance, 70% Polyvinylidene Fluoride (PVDF) coating based on Elf Atochem Inc. Kynar 500 or Ausimont USA Inc. Hylar 5000 resin, formulated by a licensed paint manufacturer, and applied by paint manufacturer's warranty-approved applicator.

E. Pretreatment:

F. Applicator to pretreat the aluminum with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by a chrome phosphate conversion coating - at minimum 40 mg/square foot – to ensure adhesion of paint to the aluminum.

G. Application:

H. One primer coat, one color coat, for a minimum of 1.2 mils of dry film thickness.

I. Color

1. Horizontal sunshades and frames: ~~As selected by architect from manufacturer's full range.~~ **Custom Color.**

2. Vertical sunshades: ~~As selected by architect from manufacturer's full range.~~ **Custom Color.**

PART 3 – EXECUTION

3.1 FIELD DIMENSIONS

- A. Verify conditions: Examine areas where work is to be performed and identify any conditions that could be detrimental to proper or timely completion.
- B. General Contractor Shall field confirm openings and elevations as shown on shop drawings prior to fabrication.
- C. Installation should not proceed until all conditions are satisfactory.

3.2 ERECTION

- A. Qualified installer needs to comply with manufacturer's installation instructions.
- B. Verify all dimensions and the supporting structure and provide accurate field measurements, so that the sunshades will be properly designed, fabricated, and fitted to the structure.
- C. Anchor Sunshade to the building and/or window glazing systems per the architectural drawings.
- D. A maximum of +/- 1/8" tolerance between any column to column spacing is acceptable.
- E. Do not cut or trim any Sunshade components without written approval by AGS, Inc.
- F. Do not erect any damaged or deformed members. Remove or replace any damaged members in the erection process as directed by AGS, Inc.
- G. Set Sunshade units level, plumb, with uniform joints.
- H. Qualified installer to erect after all adjacent painting, roofing and masonry has been completed.
- I. Install bird spikes to top surfaces indicated in drawings.

3.3 CLEANING:

- A. Clean exterior Sunshades surfaces to prevent buildup of dust and debris, refer to AGS, Inc. cleaning instructions based on the finish of the material.

3.4 PROTECTION:

- A. Protect Sunshade materials after installation to prevent damage by other tradespersons.

END OF SECTION 107113

SECTION 107300 – ALUMINUM CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Overhead Supported Aluminum Canopies
- B. Related Requirements:
 - 1. Section 107113 “Exterior Sun Control Devices”

1.2 DELEGATED ENGINEERING REQUIREMENTS

- A. Contract Documents: Concept of work specified by this Section is expressed on Drawings and in Specifications. However, they may not indicate or specify full extent of work that may be required.
- B. Delegated Engineering Responsibility: Require manufacturer to employ a delegated engineering professional to provide engineering for work of this Section to comply with concept expressed in Contract Documents.
 - 1. Engineer system to withstand structural design loads within limits and under conditions indicated, specified, or required, without material failure or permanent deformation of building structural frame or work specified according to following:
 - a. Applicable local building codes.
 - b. ASCE 7 or the more stringent Building Code requirements.
 - c. Authorities having jurisdiction.
 - d. Criteria indicated in Contract Documents.
- C. Prepare engineering calculations, shop drawings, and other submittals and affix professional seal by a Registered Engineer in the State of Nevada, according to respective jurisdictional licensing regulations.
- D. Coordination of Contract Documents and Work:
 - 1. Notify Owner and Architect of potential constructability issues between Contract Documents and execution of work. Absence of notice constitutes acceptance of conditions indicated, specified, or required, and changes caused by minor differences between delegated engineering and Contract Documents will be at no additional cost to Owner.
 - 2. Minor adjustments may be made in interest of fabrication or installation methods, techniques, or ability to satisfy concept expressed in Contract Documents, provided concept is maintained as determined by Owner and Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including additional design and construction costs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, fabrication details, dimensions of individual components and profiles, hardware, fittings, mounting accessories, features, and finishes for canopies.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include design engineer's stamp or seal on shop drawings.
2. Include plans, elevations, sections, mounting heights, and attachment details.
3. Detail fabrication and assembly of canopies.
4. Show locations for blocking, reinforcement, and supplementary structural support.

C. Delegated Engineering Calculations: Engineering calculations, sealed by delegated engineering professional in the State of Nevada, for portion of work designated as delegated engineering.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For canopies to include in operation and maintenance manuals.

1.6 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. Installer Qualifications: Fabricator of products.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 WARRANTY

- A. Special Warranty: Manufacturer and fabricator agree to repair or replace components of canopies that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including framework.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Canopy Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Structural: Refer to Drawings.

2.2 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
 1. Basis-of-Design: Mitchell Metals: Overhead Support Canopy
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections:
 1. Architectural Fabrication: Roll Formed Canopy System
 2. MASA Architectural Canopies: Extrudeck-100 Series
 3. Substitutions: See Section 016310 - Substitutions.

2.3 CANOPY FRAME AND ACCESSORY MATERIALS

- A. Steel:
 1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 2. Steel Tubing: ASTM A500/A500M.
 3. Galvanized Steel Tubing: ASTM A787/A787M.
 4. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40).
- B. Aluminum: Alloy and temper recommended by canopy manufacturer for type of use and finish indicated and with not less than the strength and durability properties of alloy and temper required by structural loads.
 1. Aluminum Plate and Sheet: ASTM B209 (ASTM B209M).
 2. Aluminum Extrusions: ASTM B221 (ASTM B221M).
 3. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, standard weight (Schedule 40).
 4. Drawn Seamless Tubing: ASTM B210 (ASTM B210M).
- C. Anchors, Fasteners, Fittings, Hardware, and Installation Accessories: Complying with performance requirements indicated and suitable for exposure conditions, supporting structure, anchoring substrates, and installation methods indicated. Corrosion-resistant or noncorrodible units; weather-resistant, compatible, nonstaining materials. Provide as

required for canopy assembly, mounting, and secure attachment. Number as needed to comply with performance requirements and to maintain uniform appearance; evenly spaced. Where exposed to view, provide finish and color as selected by Architect from manufacturer's full range.

1. Wood Screws: ASME B18.6.1.
2. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
3. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers, zinc coated.
4. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E488 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).
5. Adhesive-Bonded Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing according to ASTM E1512 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.4 ALUMINUM CANOPIES

A. Design:

1. Canopy shall use perimeter extruded gutter and extruded decking running perpendicular to wall being attached to. Extruded Decking shall be a roll-locked design where the extruded cap and pan shall interlock to make a rigid structure. Crimped decking is not allowed
2. Decking shall be a rigid roll-locked design that is self flashing and utilizes interlocking sections.
3. Canopy gutter frame shall be welded into a single frame unless shipping does not allow. If shipping does not allow, canopy frame shall be riveted together at the corners and caulked inside to make a water-tight frame.
4. Canopy shall be secured to the wall using a round support rod system which uses a galvanized steel round overhead support rod (minimum $\frac{3}{4}$ " schedule 40 pipe). The support rods shall have a galvanized steel eye bolt welded to each end. The canopy wall bracket shall be a galvanized steel eye bolt welded to the center of a 6"x6" galvanized steel plate. The support rod shall be connected to the wall bracket using a $\frac{7}{8}$ " galvanized steel Bolt, Nut, and Washers. The

canopy frame shall have a galvanized steel saddle bracket with a galvanized steel eye bolt welded to the top of it. The support rod shall be connected to the saddle bracket using a 7/8" galvanized steel Bolt, Nut, and Washers. The saddle bracket shall connect to a 2"x2" aluminum frame support tube that sits inside of the decking pan. The 2"x2" frame support tube shall connect to the gutter frame using 4 – 300 series stainless steel fasteners, 2 at each end.

a. Alternate support systems are allowed.

5. Canopies shall drain from the decking to the perimeter gutter, and discharge from the bottom of the gutter out of a downspout
6. Canopy shall be pitched toward the downspout to allow proper drainage out of the canopy frame.

B. Size: 11'-0" wide with 7'-0" overhang.

C. Fabrication:

1. Frame Fabrication: Fabricate canopy frames from aluminum. Preassemble in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
2. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
3. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Fabricate slip-fit connections exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
4. Weld corners and connections continuously. Obtain fusion without undercut or overlap. Remove welding flux immediately. At exposed corners and connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
5. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure canopies in place and to properly transfer loads.

D. Steel Finish: Manufacturer's standard baked-enamel or powder-coat finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

1. Color: As selected by Architect from manufacturer's full range.

E. Aluminum Finish: Manufacturer's standard baked-enamel or powder-coat finish complying with finish manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for supporting members, blocking, inserts, 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. General: Install canopies at locations and in position indicated, securely connected to supports, free of rack, and in proper relation to adjacent construction. Use mounting methods of types described and in compliance with Shop Drawings and fabricator's written instructions.
- B. Install canopies after other finishing operations, including joint sealing and painting, have been completed.
- C. Slip fit frame connections accurately together to form hairline joints, and tighten to secure.
- D. Weld frame connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 1. Field Welding: Comply with the following requirements:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Anchoring to In-Place Construction: Use anchors, fasteners, fittings, hardware, and installation accessories where necessary for securing canopies to structural support and for properly transferring load to in-place construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- G. Coordinate canopy installation with flashing and joint-sealant installation so these materials are installed in sequence and in a manner that prevents exterior moisture from passing through completed exterior wall and roof assemblies.

3.3 CLEANING AND PROTECTION

- A. Touch up factory-applied finishes to restore damaged or soiled areas.

- B. Galvanized Surfaces: Clean field welds, connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION 107300

SECTION 107516 – FLAGPOLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Aluminum Flagpoles.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.3 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- B. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2016.
- C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.4 SUBMITTALS

- A. See Section 013000 - Submittal Requirements, for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations.
- C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.
- D. Designer's Qualification Statement.
- E. Operation Data: Provide operating data for the controller and timer.
- F. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

1.5 QUALITY ASSURANCE

- A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed Nevada.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

- B. Protect flagpole and accessories from damage or moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as determined by the Architect.
 - 1. Basis of Design: Pole-Tech Co, Inc: www.poletch.com/#sle.
- B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.
 - 1. Concord American Industries, Inc: www.concordindustries.com/#sle.
 - 2. or Approved Equal.
- C. Substitutions: See Section 016310 - Substitutions.

2.2 FLAGPOLES

- A. Counterbalanced Pole System : Style PT-P.
 - 1. Gold Anodized Aluminum Ball
 - 2. Cast Aluminum Revolving Truck
 - 3. Solid Braid Nylon Halyard
 - 4. Bronze Swivel Snap Hooks
 - 5. 9" Cast Aluminum Cleat w/ Screws
 - 6. Steel Tabernacle
 - 7. Counterweight Material
 - 8. Galvanized Steel Anchor Bolt w/ Nuts, Flatwasher & Lockwashers
 - 9. Copper Clad Steel Lightning Rod
- B. Designed in accordance with NAAMM FP 1001.
 - 1. Material: Cone Tapered 6063-T6 Seamless Extruded Aluminum.
 - 2. Design: Cone tapered.
 - 3. Mounting: Ground mounted tiltable type.
 - 4. Outside Butt Diameter: 7 inches.
 - 5. Outside Tip Diameter: 3.5 inches.
 - 6. Nominal Wall Thickness: 0.156 inches.
 - 7. Nominal Height: 35 ft; measured from nominal ground elevation.
- C. Performance Requirements:
 - 1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 108 miles/hr wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.3 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper.

2.4 ACCESSORIES

- A. Finial Ball: Spun aluminum with gold anodic finish, 6 inch diameter.
- B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.
- C. Flag: USA design, 6 ft by 10 ft size, nylon fabric, brass grommets, hemmed edges.

2.5 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gauge, 0.0598 inch steel, galvanized, depth of 36 inches as indicated.
- B. Pole Base Attachment: As detailed on Drawings.
- C. Lightning Ground Cable: Copper No. 6 AWG, soft drawn.

2.6 FINISHING

- A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.2 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.3 INSTALLATION

- A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.
- B. Electrically ground flagpole installation.
- C. Fill foundation tube sleeve with concrete specified in Section 033000.
- D. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

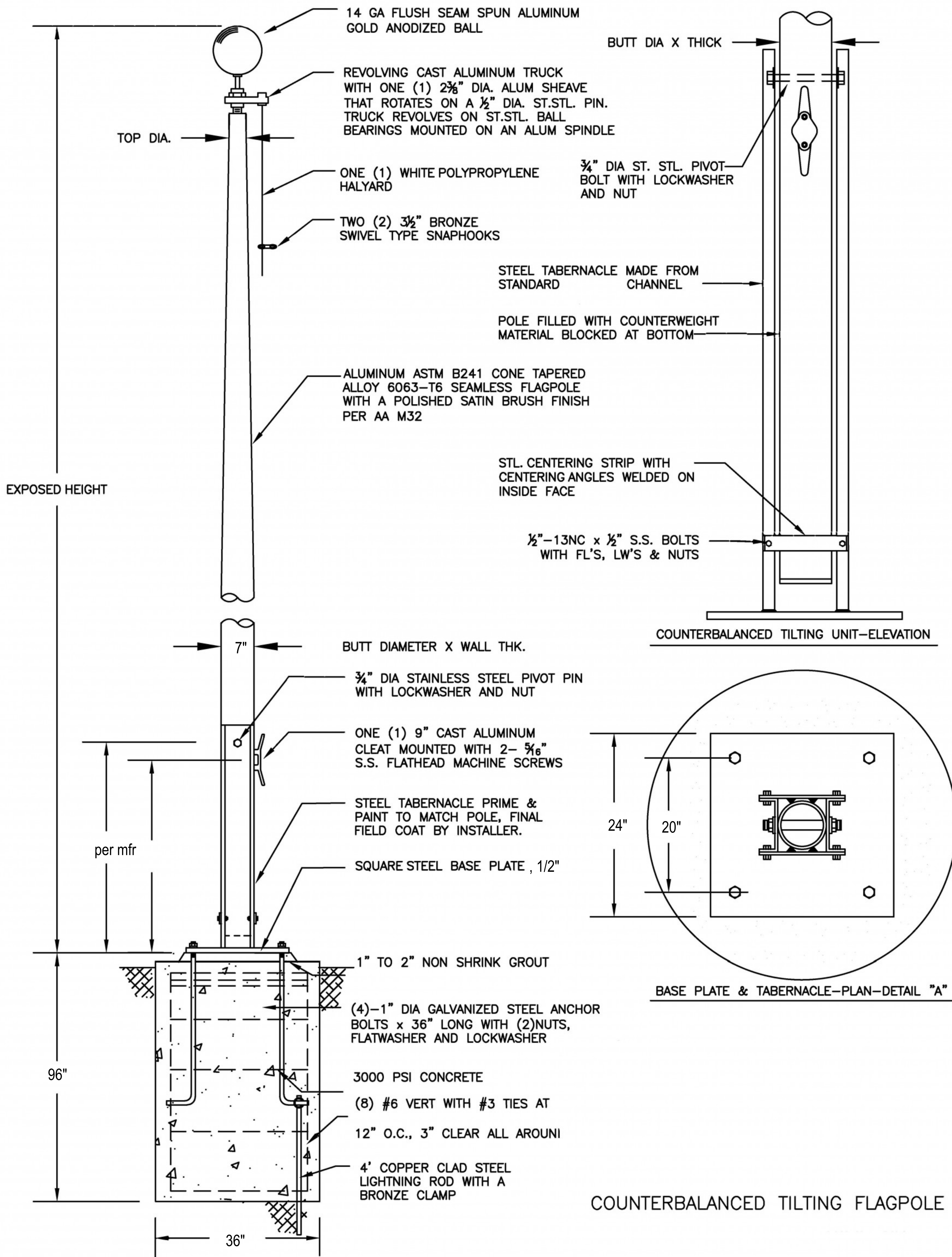
3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch.

3.5 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION **107516**



SECTION 111126 – VEHICLE WASHING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Touchless Vehicle Washing System for Buses with recycling of water
- B. Related Requirements:
 - 1. The general provisions of the Contract, including General and Supplementary Conditions, apply to the work detailed in this specification.
 - 2. Division 22 – Plumbing, for work provided separate from the vehicle washing system
 - 3. Division 26 – Electrical, for work provided separate from the vehicle washing system

1.2 QUALITY ASSURANCE

- A. Experience: The system shall be produced by a manufacturer of established reputation with a minimum of five (5) years experience supplying the specified equipment in similar applications.
- B. Installation: Provide a qualified manufacturer's representative to supervise the work related to equipment installation, check out and start up.
- C. Training: Provide a technical representative to train Owner's maintenance personnel in the operation and maintenance of specified equipment.

1.3 SUBMITTALS

- A. Product Data
 - 1. Submit Product Data in strict accordance with the requirements of these specifications.
 - 2. Restrict submitted material to pertinent data. For instance, do not include a manufacturer's complete catalog when pertinent information is contained on a single page.
 - 3. All bidders shall provide the spinner manufacturer's certified test results that the spinner to be supplied has passed the required 5,000-hour continuous test run. Such certified test results shall indicate the condition of the spinner and the spinner components after the 5,000-hour test run.
- B. Engineering Drawings
 - 1. Submittal engineering drawings must include the following:
 - a. Equipment general layout
 - b. Electrical layout
 - 1) Provide UL listing card or equivalent document of a Nationally Recognized Testing Laboratory from the company building the electrical panel(s) and attach with the electrical drawings indicating that the electrical panels will be built to the required standards (see section 2.5.1 Electric Control Panel).

- c. Mechanical layout
- d. Floor plan view
- e. Isometric view with bill of materials
- f. Any related in-ground electrical or mechanical installation

C. Operation and Maintenance Manual

- 1. Assemble and provide copies of manual in 8.5 x 11 inch format. Fold out diagrams and illustrations are acceptable. Manuals shall be reproducible by dry copy method.

1.4 SUPPLIER QUALIFICATIONS

- A. The supplier shall have been regularly engaged in the design and supply of the type of equipment specified herein, for a period of not less than five (5) years.
- B. The wash system, high pressure cleaning systems, pumping stations and all electrical controls shall be designed and supplied by one supplier.
- C. All similar items shall be the products of one manufacturer.

1.5 APPROVED EQUAL STATUS

- A. No deviations from these specifications will be allowed unless approved by the Owner in writing prior to bid closing.
- B. All bidders with an "Approved Equal Status" shall submit the following with their bid package:
 - 1. A complete list of spinner and touchless heavy duty vehicle wash systems manufactured and installed by the bidder. The list shall include all such installations made by the bidder in the last five (5) years, including the duration of service and application. Should the reference list have more than
 - a. twenty-five (25) names, a list of the last twenty-five (25) installations shall suffice.
 - 2. Provide the name of a contact person at each location that is familiar with the operation and maintenance of the wash system.
 - 3. Based on the information supplied and discussions with the contact persons named, the Owner will determine the acceptability of the proposed supplier and the equipment.

1.6 WARRANTY

- A. Warranty work specified herein is for one (1) year from the date of substantial completion against defects in materials. All rotating spinners have a three (3) year full parts warranty.
 - 1. Defects shall include, but not be limited to:
 - a. Operation: Noisy, rough or substandard operation
 - b. Parts: Loose, damaged and missing parts
 - c. Finish: Abnormal deterioration

PART 2 - PRODUCTS

2.1 SCOPE OF WORK

- A. To furnish a completely automatic, touchless heavy-duty vehicle wash system which washes the front, roof, rear, sides and chassis of the Owner's school buses and other specified vehicles in drive-through mode.
- B. The supplier is to be responsible for the supply of necessary equipment, materials and service for the complete assembly and erection of the equipment so that it is ready for operation as per these specifications.

2.2 WASH SYSTEM PERFORMANCE

- A. The equipment specified herein is based on the system model LYUS-RT2 as supplied by InterClean Equipment, Inc. (800-468-3725), Spraying System of Chicago, IL, or engineer approved equal.
 - 1. **Acceptable Alternate: Hydro-chem 2 Step Bus Wash with Reclamation.**
- B. Regardless of the Owner's approval for any deviations and/or changes, the supplier is solely responsible for the performance of the supplied equipment per these specifications. All equipment and equipment functions must be built and designed to these specifications.
- C. Should the equipment not perform as per these specifications, the supplier shall modify, add and/or alter the equipment supplied at his own expense until the performance is satisfactory.
- D. The equipment offered shall be the latest standard product, modified as necessary to meet the requirements of this specification, of a type:
 - 1. that has been commercially available and in satisfactory use for at least five years.
- E. The vehicle washer shall be actuated in cycle sequence by vehicles driven in a fixed path between tire guides at a slow speed (50-60 feet / minute) through the washing system. All washing operations shall be automatically activated by the vehicle (driving through).
- F. The supplier is responsible to design the equipment to satisfactorily wash up to 30 vehicles per hour. The vehicle wash shall be able to remove all visible heavy dirt accumulation and most of the road film from the Owner's vehicles when driven through the washer at 50 feet / minute, using only alkaline detergents. The amount of detergent used per vehicle to remove road film shall not exceed 0.20 gallons. The evaluation of the system capability to remove road film shall be determined only after washing has been completed and the vehicles have dried.
- G. The vehicle wash system must be capable of washing specified vehicles up to 14' in height including the following:
 - 1. Cars, Pick-ups, Vans
 - 2. Buses, School buses
 - 3. Utility trucks with or without attached equipment
- H. The vehicle wash system will use a water reclamation system.

2.3 MECHANICAL INTERCONNECTING PIPING

- A. All field plumbing and mechanical work will be done by licensed Mechanical Contractor under contract with the General Contractor, including:
 - 1. Water and gas utilities up to and connecting to the equipment.
 - 2. Interconnecting piping between various equipment components located in the equipment room.
 - 3. Interconnecting piping between the equipment located in the equipment room and the equipment located in the wash bay.
 - 4. Furnish and installation of:
 - a. Exhaust duct for water heater
 - b. Backflow preventer
 - c. Underground pipe for chassis wash
 - d. Grating for trench

2.4 ELECTRICAL INTERCONNECTING WIRING

- A. All field electrical work will be done by a licensed Electrical Contractor under contract with the General Contractor, including:
 - 1. Electrical service up to and connecting to the equipment panel.
 - 2. Interconnecting wiring between various equipment components located in the equipment room.
 - 3. Interconnecting wiring between the equipment located in the equipment room and the equipment located in the wash bay.
 - 4. Furnish and installation of:
 - a. Underground conduits (if required) to be laid when concrete pad is being poured.

2.5 WASH SYSTEM TECHNICAL SPECIFICATIONS

- A. Detergent Arch Components
 - 1. Timing of operation and position of the detergent arch shall be determined by the manufacturer to provide optimum detergent penetration before high-pressure wash cycle.
 - 2. Detergent injector shall be Inject-O-Meter, InterClean DM or engineer approved equal with adjustable chemical injection ratio from 1:20 to 1:100. The ratio of detergent delivery (by the injector) must be readable on the injector calibrated settings. The detergent injector must be of the positive displacement type.
 - 3. The system shall have a water booster pump to ensure even water pressure.
 - 4. The detergent arch shall be made of 1.25 inch stainless steel pipe, compatible with selected detergents, and equipped with 25 pieces of adjustable Spraying Systems Swivel Nozzle Bodies 4202-T with Spraying Systems Diaphragm Check Valve Model 8360 to evenly apply hot water/detergent solution to front, rear, sides and roof of the vehicle proceeding through the arch. The design of the detergent arch shall allow immediate activation of the nozzles upon arch activation by the vehicle.
 - 5. The chemical spray components located in the equipment room must be assembled in a modular, wall-mounted assembly.
 - 6. The detergent arch shall have an Intensified Rear Detergent Feature. The application of detergent to the rear of the vehicle shall be done via a separate, stainless steel rear wash arch. This arch will be activated immediately after the vehicle has passed through the detergent arch. The detergent concentration for the rear wash arch shall

be double that of the detergent arch. The Intensified Rear Detergent arch shall be controlled and operated by its own vehicle sensing device, solenoid valves and chemical pumps as required for proper performance.

7. The detergent arch shall be activated by a limit switch assembly. This assembly is to be mounted on the adjustable height steel frame located at the front of the wash. The limit switch assembly shall be able to be activated by all sizes of vehicles.
8. The detergent arch shall be supplied hot water through a gas fired hot water heater. The heater shall be a minimum of 199,000 BTU.
9. A water softener for the detergent arch is required to be included by the supplier if the domestic water exceeds 3 grains of hardness. Should the water softener not be needed, the supplier shall provide to the Owner testing results proving the water hardness is acceptable (3 grains or lower).

B. High Pressure Spinner Assembly

1. High pressure cleaning shall be achieved using eight (8) rotating spinners mounted on one common self-supporting arch assembly. Four (4) spinners are mounted on each side of the arch for complete coverage for all shapes and sizes of vehicles including wheels and insides of wheel wells.
2. The high pressure arch shall be made of 2 inch Schedule 40 galvanized pipe. The spinner(s) position in relation the vehicle shall be adjustable vertically and horizontally.
3. The three bottom spinners on each side must be protected by 2 inch Schedule 40 galvanized spinner protection guards. Should the vehicle jump the tire guide, spinners shall be protected spinner guards which will allow the complete spinner arch assembly to swing aside when struck by a vehicle. Systems without protection for the spinners shall not be acceptable.

C. Chassis Wash System

1. The chassis wash system shall have two of the specified or engineer approved spinners located in the center trench for effective under-chassis cleaning. Normal spray nozzles, stationary or oscillating, are not acceptable.
2. The chassis wash spinners shall be mounted in the pit trench by a removable (for cleaning purposes) modular skid assembly.
3. The removable chassis wash assembly shall be equipped with a protective plate at the bottom of the assembly. This plate will prevent a person, who accidentally steps into the chassis wash spinner opening, from further falling into the trench.

D. Spinners

1. Spinners are to be CENTRI*SPINNER, Spraying Systems Spinner or engineer approved equal. All spinners submitted for approved equal must have been tested and passed a 5,000 hour continuous test run.
2. Each spinner is to have four (4) fully adjustable spray nozzles. The nozzles are to be of the zero degree type and be supported at the end by adjustable position elbows.
3. The rotational speed of each spinner is to be adjustable between 90 – 300 RPM. The rotational speed adjustment of the spinners is to be achieved through an internal oil pump. No free-floating oil pump gears without center shaft supports will be acceptable.
4. The rotational high-pressure water seal must be of the mechanical seal type.
5. The spinner inlet hookup must be a minimum of 1" stainless steel. Spinners equipped with smaller inlet hookups shall not be acceptable.

6. The nozzles are to be equipped with air jet nozzles. Zero degree water is to pass through the secondary orifice, which will be a minimum of three (3) inches long and have eight (8) openings for air intake at the joint of the spray nozzle and air jet nozzle. Air jets and nozzles must be made of stainless steel. Spinners not equipped with air jet nozzles are not acceptable.
 7. The spinner assembly shall have no periodic maintenance or lubrication requirements.
- E. Spinner Adjuster Tool
1. The spinner adjuster tool, to set all four spinner elbows in an exact, pre-determined angle, shall be supplied with the system.
 2. Adjustment of spinner elbow angles to a precise position by the adjustment tool shall be done without removing the spinners from the arch.
- F. Intensified Rear Wash System
1. The Intensified Rear Wash System shall be activated after the vehicle passes the high pressure spinner arch. The separate rear wash arch shall be made of a minimum of 2" Schedule 40 galvanized piping with an output minimum of 240 GPM at 300 PSI
 2. The supplier shall guarantee that the rear of the vehicle passing through the system at the speed of 50 feet/minute shall be cleaned as effectively as the rest of the vehicle.
 3. The rear wash arch shall be activated only for the rear of the vehicle and shall immediately (automatically) shut off after the vehicle has passed.
 4. The rear wash shall utilize a co-axial 3-way valve with the following features:
 - a. The valve shall utilize a control tube that moves linearly along the same axis as the fluid flow.
 - b. The valve shall be pressure balanced so that operation is unaffected by inlet pressure or pressure fluctuations.
 - c. The design life cycle for the intended application shall be a minimum of 500,000 cycles.
 - d. Adjustable switching time shall be 150 – 2,000 milliseconds.
 - e. The valve shall have wear compensating seats.
 5. The rear wash arch shall use either rotating spinners, oscillating zero degree nozzles or other supplier selected method for effective rear wash arrangement. The rear wash arch shall be totally separate and independent from the high pressure spinner arch. The supplier is solely responsible for the performance warranty regardless of the chosen method.
- G. Pumping Module
1. Pump: The high pressure pump shall be of the centrifugal diffuser type as manufactured by ITT/Goulds Pump and shall be capable of producing pressures up to 320 PSI. The pump shall deliver a maximum flow of 240 GPM as determined by the nozzle sizes incorporated in zero degree spinners.
 2. Casing: The suction casing shall be 3.0 inch 250 lb. ANSI flat faced flanged. It shall be oriented to right angles of the vertical center line when viewed from the drive end. The discharge is 2.5 inch 600 lb. ANSI raised face flange oriented on the vertical center line. The suction casing, discharge casing, stage casings and diffusers are made of ductile iron, free from blow holes, sand pockets, or other detrimental defects. Flow passages are smooth to permit maximum efficiency. Pump shall be equipped

with external tie bolts to hold the radially split casing sealed by 'O' rings. The casing shall be capable of withstanding the hydrostatic test pressure of 150% of the maximum pumping pressure under which the pump could operate at the designed speed.

3. Impellers: The impellers are of the enclosed single suction type, hydraulically balanced to minimize axial thrust loads. Each impeller is individually keyed to the shaft. Impeller is bronze.
4. Stuffing Box: Packed type stuffing boxes shall be equipped with a mechanical seal.
5. Shaft Sleeves: The shaft sleeve through the stuffing box is 11-13% chrome stainless steel hardened to a minimum of 225 Brinnel and is keyed to shaft.
6. Shaft: The shaft is standard carbon steel adequately sized for loads transmitted.
7. Bearing: The bearings are designed for an average life of 50,000 hours. The outboard bearing is a deep groove type; the inboard bearings are of the radial roller type with grease fittings.
8. Base: A steel base plate contains the mounting of the pump and motor, which are carefully aligned and bolted in place prior to shipment. Final alignment will be checked and certified after installation and prior to operation by the user.
9. Coupling: The pumping module shall have a "Jaw" type coupling as manufactured by Lovejoy or equal and includes a coupling guard.

H. Electric Motor

1. The electric motor shall be of the squirrel cage induction type suitable for across the line starting.
2. The motor shall operate on 460 Volt, 3 Phase, 60 Cycle and be OPSB with a 1.15 service factor.
3. The motor shall be sized to not exceed the name plate horse power during operation. The motor should be a minimum of 60 HP.

I. Electric Control Panel and Components

1. The panel and controls must be built according to these specifications. No substitutions shall be allowed. The control system shall be PLC based with separate HMI.
2. The PLC shall be the process application controller and provide near real time control of the entire wash system. It shall be connected to distributed I/O via an Ethernet network. The operator interface shall be through a separate HMI not integral to the PLC, connected to the PLC via Ethernet
3. The PLC shall be panel mounted in a 48"x36"x12" electrical enclosure, which also houses the electrical controls for the wash system. The PLC may be mounted in its own enclosure in an office environment. The PLC provides the centralized infrastructure to enable simple and complete integration with other systems.
4. The PLC and HMI programs shall be developed and provided by the bidder. These programs shall include the specified wash components and provide capacity for future expansion. The PLC program shall be provided in RSLogix 5000 v20 and the HMI program shall be provided in RSVIEW ME v6.1
5. PLC and HMI programs shall provide the following:
 - a. GUI shall be intuitive to use by people without computer experience. Little or no training should be required.
 - b. At program start up, all devices shall be initialized to a known state.

- c. All system settings, such as baud rates, parity, comm. port configurations, etc shall be reconfigurable without necessitating recompiling the application software.
 - d. All user configurable settings shall be stored in the PLC and/or HMI and saved to their respective SD cards. These include all timing set points, alarm settings, and communication settings.
 - e. Periodic polling of I/O shall be every 20 ms or less.
 - f. Alarms should have user configurable delays to prevent nuisance tripping.
 - g. Latency: scanning interval for all closed loop processes should be executed <20 ms.
 - h. Provide terminal windows for spying on any devices communicating to PC via Ethernet, RS232, etc. These will be used for troubleshooting communications problems.
 - i. Failure of any single component shall result in disabling the entire wash. For example, the system will not be allowed to wash vehicles in a crippled state if a chemical pump motor overload trips.
 - 6. The Industrial Control Panel shall be manufactured and evaluated in accordance with the Underwriters Laboratories, Inc. (UL) standard 508A (Industrial Control Panels). In addition, the panel shall be evaluated for high-capacity short circuit withstand and shall bear the appropriate UL marks including the short circuit withstand value mark as part of the official UL label.
 - 7. The industrial Control Panel shall be designed for operation on a 460 Volt, 3 phase, 60 Hertz system, with a short circuit capacity of 65,000 amperes RMS Symetrical available at the incoming line terminals of the control panel.
 - 8. The Industrial Control Panel shall be designed to meet the requirements of the National Electric Code (NEC) Articles 430 and 670, also the National Fire Protections Association (NFPA) Standard 79 (Industrial Machinery).
 - 9. E-Stop related operator controls, all push buttons, selector switches, pilot devices, system control and access functions must be by Touch Screen Operator Interface Terminal.
 - 10. Electric Panels that are not UL approved are not acceptable.
 - 11. The activation switches shall be designed to be activated by all fleet vehicles used by the owner. Each activator shall be pre-mounted and wired to a water tight junction box equipped with built-in drainage holes.
- J. Tire Guides
- 1. Tire guides shall be fabricated from 3 inch diameter painted steel pipe headings, supported at 5 foot intervals, to provide guide runs on both sides of the vehicle. The tire guides shall run the full length of the wash system.
 - 2. The system shall have an angled entry. The ends of the rails are capped and all headings are smoothly finished to prevent tire damage. Brackets supporting the pipe shall be made of a minimum 3/8" steel plate that is welded to concrete imbedded cleats or anchor bolted to the concrete.
- K. Water Holding Tank
- 1. The system shall be equipped with a 925 gallon polyethylene water holding tank equipped with high and low level float switches. The system holding tank shall be filled with water from fresh city water or reclaimed water from the vehicle wash system. It will be equipment suppliers responsibility to supply adequate filtering for

the water purification as is required for the proper cleaning and film removing requirements.

2. The holding tank shall be filled via 2", slow closing solenoid valve activated by a high level float switch in the holding tank.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment shall be installed in accordance with manufacturer's supplied installation drawings.
- B. Equipment supplier shall undertake the commissioning of the system and make all required adjustments to ensure proper operation.
- C. The equipment manufacturer shall start up the system. The Owner shall have all operating personnel present during the start up and equipment training.
- D. The supplier shall arrange for an adequate amount of detergent to be available for the performance testing.

3.2 CLOSEOUT

- A. The Owner's personnel shall be trained for a minimum of five (5) hours in the system's operation and maintenance.
- B. The supplier shall provide the Owner with the names and addresses of all local service and maintenance personnel to assist in future service.

END OF SECTION 111126

SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Refrigeration appliances.
 - 2. Cleaning appliances.
- B. Related Requirements:
 - 1. Section 224100 "Residential Plumbing Fixtures" for kitchen sinks, dishwasher air-gap fittings, and waste (garbage) disposers.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Refrigeration appliances.
 - 2. Cleaning appliances.
- B. Product Data Submittals: For each product.
 - 1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Product Certificates: For each type of appliance.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturers' special warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintains, within **<Insert miles (km)>** of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

1.6 WARRANTY

- A. Dishwasher: Limited warranty, including parts and labor, for on-site service on the product.
 - 1. Warranty Period: One year from date of Substantial Completion.
- B. Clothes Washer: Limited warranty, including parts and labor for first year and motor parts thereafter, for on-site service on the product.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain [residential appliances from single source] [and] [each type of residential appliance from single manufacturer].

2.2 PERFORMANCE REQUIREMENTS

- A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.3 CLEANING APPLIANCES

- A. Dishwasher (Q106): Complying with AHAM DW-1.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GDT226S or a comparable product by one of the following:
 - a. Kenmore; Transformco SR Brands LLC.
 - b. Maytag; Whirlpool Corporation.
 - c. Whirlpool Corporation.
 - 2. Type: Built-in undercounter.
 - 3. Dimensions:
 - a. Width: 23-3/4 inches (604 mm).
 - b. Depth: 23-1/2 inches (597 mm).
 - c. Height: 32-1/4 inches (820 mm).
 - 4. Tub and Door Liner: Stainless steel with sealed detergent and automatic rinsing-aid dispensers.
 - 5. Rack System: Nylon-coated sliding dish racks.
 - 6. Controls: Touch-pad controls.
 - 7. Features:
 - a. Waste food disposer.
 - b. Self-cleaning food-filter system.
 - 8. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
 - 9. Front Panel: Stainless steel.

10. Appliance Color/Finish: Stainless steel.
11. ADA Compliant

B. Clothes Washer (Q108): Complying with AHAM HLW-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GFW550SSNWW or a comparable product by one of the following:
 - a. Kenmore; Transformco SR Brands LLC.
 - b. Maytag; Whirlpool Corporation.
 - c. Whirlpool Corporation.
2. Type: Stacking, front-loading unit.
3. Dimensions:
 - a. Width: 28 inches (712 mm).
 - b. Depth: 32 inches (813 mm).
 - c. Height: 39-3/4 inches (1010 mm).
4. Drum: Stainless steel.
 - a. Capacity: 4.8 cu. Ft.
5. Electrical Power: As indicated on Drawings.
6. Motor: Manufacturer's standard with built-in overload protector.
7. Features:
 - a. Reversible door.
8. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
9. 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.
10. Appliance Finish: Enamel.
 - a. Color: White.
11. Front-Panel Finish: Manufacturer's standard.
 - a. Panel Color: White.

C. Clothes Dryer (Q108): Complying with AHAM HLD-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GFD55ESSNWW or a comparable product by one of the following:
 - a. Kenmore; Transformco SR Brands LLC.
 - b. Maytag; Whirlpool Corporation.
 - c. Whirlpool Corporation.
2. Type: Stacking, frontloading, electric unit.
3. Dimensions:
 - a. Width: 28 inches (712 mm).
 - b. Depth: 32 inches (813 mm).
 - c. Height: 39-3/4 inches (1010 mm).
4. Drum: Manufacturer's standard.
 - a. Capacity: 7.8 cu. ft.
5. Electric-Dryer Power: As indicated on Drawings.
6. Features:
 - a. Stacking kit to stack dryer over washer.
7. Appliance Finish: Enamel.
 - a. Color: White.

- 8. Front-Panel Finish: Manufacturer's standard.
 - a. Panel Color: White.

2.4 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, areas, 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. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install appliances according to manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113013

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manually operated, single-roller shades.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.
- C. Samples for Verification: For each type of roller shade.
 - 1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark interior face of material if applicable.
- D. Product Schedule: For roller shades.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades 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. Roller Shades: Two full-size units for window type A.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. 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 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 SOURCE LIMITATIONS

- A. Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED, SINGLE-ROLLER SHADES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Lutron Electronics Co., Inc ; Contract Roller Shades. or a comparable product by one of the following:
 - 1. Draper, Inc.
 - 2. Hunter Douglas Architectural.
- B. 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.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criterion is more stringent.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 1. Roller Drive-End Location: Coordinate with Architect.
 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
 3. Shadeband-to-Roller Attachment: Adhesive strip.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- F. Shadebands:
 1. Shadeband Material: Light-filtering fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Installation Accessories:
 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches (102 mm).
 2. Endcap Covers: To cover exposed endcaps.
 3. 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. Thickness: 0.02 inches
 4. Openness Factor: 1 percent
 5. 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 (23 deg C):
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).
 - 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, 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.
- B. Roller Shade Locations: As indicated on Drawings.

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.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.

1.2 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches (150 mm) square.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance with at least 10 years experience.
- B. Installer Qualifications: Fabricator of countertops with at least 5 years experience on similar jobs.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1. Provide grommets for all small utility penetrations whether indicated in drawings or not.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide DuPont; DuPont de Nemours, Inc.; Corian Solid Surface Countertops or a comparable product by one of the following:
 - a. Affinity Surfaces; a brand of Domain Industries, Inc.
 - b. Avonite Surfaces; a Brand of Aristech Surfaces LLC.
 - c. Formica Corporation.
 - d. Wilsonart LLC.
 2. Type: Provide Standard type unless Special Purpose type is indicated.
 3. Colors and Patterns: Locations indicated on drawings
 - a. SSM1 – As selected by Architect from manufacturer's price group C or equivalent range.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 1. Grade: Custom.
- B. Configuration:
 1. Front: Radius edge, 1-1/2 inches high with 1/4-inch radius.
 2. Backsplash: Straight, slightly eased at corner.
 3. End Splash: Matching backsplash wherever sidewalls occur.
- C. Countertops:
 1. 3/4-inch- (19-mm-) thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 3/4-inch- (19-mm-) thick, solid surface material.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 1. Fabricate with loose backsplashes for field assembly.
- F. Joints:
 1. Fabricate countertops in sections for joining in field.
 - a. Joint Locations: Not within 18 inches (450 mm) of a sink or cooktop and not where a countertop section less than 36 inches (900 mm) long would result, unless unavoidable.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
4. Utility Penetrations: Drill countertops in shop for small utility, wiring, and conduit penetrations and similar items. Provide grommets for all small round penetrations.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural-steel framing.
 - 2. Thermal insulation.
- B. Related Requirements
 - 1. Section 042200 "Concrete Unit Masonry" for perimeter and other walls as shown on drawings.
 - 2. Section 074116 "Insulated Metal Roof Panels" for roofing
 - 3. Section 074213.19 "Insulated Metal Wall Panels" for walls
 - 4. Section 074293 "Soffit Panels" for metal soffit panels.
 - 5. Section 076200 "Sheet Metal Flashing and Trim"
 - 6. Section 077100 "Roof Specialties" for gutters and downspouts
 - 7. Section 077129 "Manufactured Roof Expansion Joint" for seismic connection at roofs
 - 8. Section 077258 "Snowguards"
 - 9. Section 078100 "Applied Fire Protection" for spray-applied fire-resistive materials applied to secondary roof structural members
 - 10. Section 078123 "Intumescent Fire Protection" for intumescent protection applied to primary structural frame
 - 11. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for seismic connection at walls
 - 12. Section 081113 "Hollow Metal Doors and Frames" for personnel doors and frames
 - 13. Section 083323 "Overhead Coiling Doors"
 - 14. Section 085113 "Exterior Aluminum Windows"
 - 15. Section 088000 "Glass and Glazing"
 - 16. Section 089119 "Fixed Louvers"
 - 17. Section 412246 "Ceiling Mounted Work Station Steel Bridge Crane" for ceiling mounted bridge crane attached to structure.
 - 18. Section 416720 "Fall Arrest Anchor System" for ceiling mounted fall arrest system attached to structure.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and attachments to other work.
- C. Samples: For units with factory-applied finishes.
- D. Delegated Design Submittals: For metal building systems.

1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 1. Name and location of Project.
 2. Order number.
 3. Name of manufacturer.
 4. Name of Contractor.
 5. Building dimensions including width, length, height, and roof slope.
 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 7. Governing building code and year of edition.
 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- C. Material test reports.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 1. Accreditation: Manufacturer's facility accredited according to IAS AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems." **Or**
 2. **Accreditation: AISC certified metal building fabricator for steel manufacturing and provides steel manufacturing in accordance with MBMA Metal Building Systems Manual.**
 3. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A&S Building Systems, Inc.; part of the Cornerstone Building Brands.
 - 2. ACI Building Systems, Inc.
 - 3. All American Systems; a division of NCI Building Systems, Inc.
 - 4. Alliance Steel, Inc.
 - 5. American Buildings Company; a Nucor company.
 - 6. BC Steel Buildings, Inc.
 - 7. Behlen Mfg. Co.
 - 8. Bigbee Steel Buildings, Inc.
 - 9. Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.
 - 10. CBC Steel Buildings; a Nucor company.
 - 11. Ceco Building Systems; part of the Cornerstone Building Brands.
 - 12. Chief Buildings; Chief Industries, Inc.
 - 13. Dean Steel Buildings, Inc.
 - 14. Garco Building Systems; a division of NCI.
 - 15. Golden Giant Inc.
 - 16. Gulf States Manufacturers; Nucor Company.
 - 17. Heritage Building Systems, part of the Cornerstone Building Brands.
 - 18. Inland Building Systems; a Schulte Building Systems Company.
 - 19. Kirby Building Systems; a Nucor Company.
 - 20. Ludwig Buildings Enterprises, LLC.
 - 21. Mesco Building Solutions, part of the Cornerstone Building Brands family.
 - 22. Metallic Building Systems, part of the Cornerstone Building Brands.
 - 23. Mid-West Steel Building Company; an NCI company.
 - 24. Mueller, Inc.
 - 25. Nucor Building Systems; a Nucor company.
 - 26. Package Steel Systems, Inc.
- B. **Or: Fabrication facilities that are accredited by the American Institute of Steel Construction to engineer and fabricate Pre-Engineered Metal Buildings.**

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.

- B. Structural Performance: Metal building systems to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings and as required by the 2018 International Building Code.
 - a. Include loads as required for work station crane hoist system and fall arrest tether system at location shown on drawings.
 - 2. Deflection and Drift Limits:
 - a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - b. No greater than the following:
 - 1) Purlins and Rafters: Vertical deflection of $1/150$ of the span.
 - 2) Girts: Horizontal deflection of $1/120$ of the span.
 - 3) Metal Roof Panels: Vertical deflection of $1/150$ of the span.
 - 4) Metal Wall Panels: Horizontal deflection of $1/180$ of the span.
 - 5) Spandrel Beams Supporting Masonry Wall Out of Plane: $1/240$ of the span.
 - 6) Jamb Studs, Wind Columns, or other vertical elements supporting Spandrel beams: $1/240$ of the span.
 - 7) Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - 8) Lateral Drift: Maximum of $1/60$ of the building height.
- C. Seismic Performance: Metal building system to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- 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: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.
- F. Fire-Rated Door Assemblies: 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.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

- G. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
- H. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
 - 1. Roof:
 - a. As indicated on drawings
 - 2. Walls:
 - a. As indicated on drawings

2.3 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters and rake beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
 - 1. **Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.**
 - a. **Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80 (230 through 550), or HSLAS or HSLAS-F, Grades 50 through 80 (340 through 550); with G90 (Z275) coating designation.**

- G. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.

2.4 METAL ROOF PANELS

- A. Refer to section 074116 “Insulated Metal Roof Panels”

2.5 METAL WALL PANELS

- A. Refer to Section 074213.19 “Insulated Metal Wall Panels”

2.6 METAL SOFFIT PANELS

- A. Refer to section 074293 “Soffit Panels”

2.7 THERMAL 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. Bay Insulation Systems; a division of Bay Industries.

- B. Faced Metal Building Insulation: ASTM C991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.

- C. Unfaced Metal Building Insulation: ASTM C991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.

- D. Retainer Strips: For securing insulation between supports, 0.025-inch (0.64-mm) nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.

- E. Vapor-Retarder Facing: ASTM C1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E96/E96M, Desiccant Method.

- 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. Lamtec Corporation.

2.8 PERSONNEL DOORS AND FRAMES

- A. Refer to section 081113 “Hollow Metal Doors and Frames”

2.9 WINDOWS

- A. Refer to section 085113 “Exterior Aluminum Windows”

- B. Glazing: Comply with requirements specified in Section 088000 "Glazing."

2.10 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - 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.
- B. Roof Panel Accessories: Refer to section 074116 "Insulated Metal Roof Panels"
- C. Wall Panel Accessories: Refer to Section 074213.19 "Insulated Metal Wall Panels"
- D. Flashing and Trim: Refer to Section 076200 "Sheet Metal Flashing and Trim"
- E. Gutters and Downspouts: Refer to section 077100 "Roof Specialties"
- F. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
 - 1. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot- (3-m-) long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
 - a. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; or aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.6-mm) wire.
 - b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches (914 mm) of floor.
 - c. Throat Size: As standard with manufacturer, and as required to comply with ventilation requirements.
- G. Roof Curbs: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.048-inch (1.21-mm) nominal uncoated steel thickness prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
- H. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.11 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

2.12 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
 1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, ventilators, and other penetrations of roof and walls.
- H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
 2. Space, adjust, and align joists accurately in location before permanently fastening.
 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 4. Joist Installation:
 - a. Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
 - b. Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
 - c. Weld joist seats to supporting steel framework.
 5. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.2 FIRE PROTECTION

A. Apply Intumescent and spray applied fire resistive coatings per manufacturer's installation requirements.

3.3 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
3. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

- a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
- 5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
 - 1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.4 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to NAAMM-HMMA 840.
 - 1. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.
- C. Field Glazing: Comply with installation requirements in Section 088000 "Glazing."
- D. Door Hardware:
 - 1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - 4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 079200 "Joint Sealants."

3.5 WINDOW INSTALLATION

- A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.
 - 1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Set sill members in bed of sealant or with gaskets, for weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

- D. Mount screens directly to frames with tapped screw clips.

3.6 ACCESSORY INSTALLATION

- A. General: 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 roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. 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. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 - 1. Install exposed flashing and trim that is without excessive oil-canning, 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 result in waterproof and weather-resistant performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
 - 1. Provide elbows at base of downspouts to direct water away from building.
 - 2. Tie downspouts to underground drainage system indicated.
- E. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.

- F. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- G. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.7 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 133419

Washoe County School District Transportation Yard Modernization

CDS Project No. 202211



Bid Set Project Manual Volume II Divisions 21-41

*1980 Kleppe Lane
Sparks, NV 89431
20 September, 2024*

COLLABORATIVE
DESIGN
STUDIO *architecture of experience and place*

WCSD Central Transportation Yard Modifications - Sparks, Nevada
Collaborative Design Studio Project No. 202211

BID SET
15 August, 2024

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SECTION 210516 - EXPANSION FITTINGS AND LOOPS FOR FIRE SUPPRESSION PIPING

1.1 SUMMARY

- A. Section Includes:
 - 1. Packless expansion joints.
 - 2. Alignment guides and anchors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Warranty Information.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.2 PACKLESS EXPANSION JOINTS

- A. Flexible-Hose Packless Expansion Joints:
 - 1. Basis-of-Design Product, subject to compliance with the specified product on the drawings, provide a product by one of the following manufacturers:
 - a. Twin City Hose.
 - b. Engineered Hose.
 - c. Flex-Hose.
 - d. Unisource.
 - e. Or Approved Equal.
 - 2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, V-shaped bend, or center section of flexible hose. Hoses shall be NFPA-13 compliant.
 - 3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.

4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
 - a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
 - b. Hoses on domestic hot water, cold water, and hot water return shall be NSF-61, Lead-Free compliant.
5. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon steel fittings with threaded end connections.
 - a. Stainless steel hoses and single-braid, stainless steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
 - b. Joints used for natural gas shall be UL-listed for natural gas use.
6. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon steel fittings with flanged end connections.
 - a. Stainless steel hoses and single-braid, stainless steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

2.3 ALIGNMENT GUIDES AND ANCHORS

- A. Alignment Guides:
 1. Guides shall be manufactured by the flexible hose manufacturer.
 2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.
- B. Anchor Materials:
 1. Steel Shapes and Plates: ASTM A36/A36M.
 2. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
 3. Washers: ASTM F844, steel, plain, flat washers.
 4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Stud: Threaded: Stainless steel.
 - b. Expansion Plug: Stainless steel.
 - c. Washer and Nut: Stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION JOINTS - GENERAL

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.

3.2 INSTALLATION OF ALIGNMENT GUIDES AND ANCHORS

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install one guide on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe, and secure guides to building structure.

- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:
 - 1. See structural drawings for anchor attachment specifications.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - 1. See structural drawings for anchor attachment specifications.

3.3 INSTALLATION OF PIPE LOOP AND SWING CONNECTIONS

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

END OF SECTION 210516

SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company.
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space

between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
 - 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 210517

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

- g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
 - C. Install floor plates for piping penetrations of equipment-room floors.
 - D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.
- 3.2 FIELD QUALITY CONTROL
- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

SECTION 210523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Iron butterfly valves with indicators.
 - 2. Check valves.
 - 3. Iron OS&Y gate valves.
 - 4. NRS gate valves.
 - 5. Indicator posts.
 - 6. Trim and drain valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
 - 1. Main Level: HAMV - Fire Main Equipment.
 - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
 - b. Level 1: HLOT - Valves.
 - 1) Level 3: HLUG - Ball Valves, System Control.
 - 2) Level 3: HLXS - Butterfly Valves.
 - 3) Level 3: HMER - Check Valves.
 - 4) Level 3: HMRZ - Gate Valves.
 - 2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
 - a. Level 1: VQGU - Valves, Trim and Drain.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
 - 1. Automated Sprinkler Systems:
 - a. Indicator posts.
 - b. Valves.
 - 1) Gate valves.
 - 2) Check valves.
 - a) Single check valves.
 - 3) Miscellaneous valves.
- C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.
- D. ASME Compliance:
 - 1. ASME B16.1 for flanges on iron valves.
 - 2. ASME B1.20.1 for threads for threaded-end valves.
 - 3. ASME B31.9 for building services piping valves.

- E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- F. NFPA Compliance: Comply with NFPA 24 for valves.
- G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. Valve Actuator Types:
 - 1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
 - 2. Handwheel: For other than quarter-turn trim and drain valves.
 - 3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.2 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Anvil International.
 - 2. NIBCO INC.
 - 3. Tyco Fire.
 - 4. Victaulic Company.
 - 5. Zurn Industries, LLC.
- B. Description:
 - 1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
 - 2. Minimum Pressure Rating: 175 psig.
 - 3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
 - 4. Seat Material: EPDM.
 - 5. Stem: Stainless steel.
 - 6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
 - 7. Actuator: Worm gear or traveling nut.
 - 8. Supervisory Switch: Internal or external.
 - 9. Body Design: Lug or wafer.

2.3 CHECK VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Anvil International.
 - 2. Mueller Co.
 - 3. NIBCO INC.
 - 4. Tyco Fire.
 - 5. Victaulic Company.
- B. Description:
 - 1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.

2. Minimum Pressure Rating: 175 psiga.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.4 IRON OS&Y GATE VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. NIBCO INC.
 2. Victaulic Company.
 3. Watts.
 4. Zurn Industries, LLC.
- B. Description:
 1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
 2. Minimum Pressure Rating: 175 psig.
 3. Body and Bonnet Material: Cast or ductile iron.
 4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
 5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
 6. Stem: Brass or bronze.
 7. Packing: Non-asbestos PTFE.
 8. Supervisory Switch: External.
 9. End Connections: Flanged or Grooved.

2.5 NRS GATE VALVES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Mueller Co.
 2. NIBCO INC.
 3. Victaulic Company.
 4. Zurn Industries, LLC.
- B. Description:
 1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
 2. Minimum Pressure Rating: 175 psig.
 3. Body and Bonnet Material: Cast or ductile iron.
 4. Wedge: Cast or ductile iron with elastomeric coating.
 5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
 6. Stem: Brass or bronze.
 7. Packing: Non-asbestos PTFE.
 8. Supervisory Switch: External.
 9. End Connections: Flanged or Grooved

2.6 INDICATOR POSTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Cast Iron Pipe Company.
 - 2. Clow Valve Company.
 - 3. Kennedy Valve Company.
 - 4. Mueller Co.
 - 5. NIBCO INC.
- B. Description:
 - 1. Standard: UL 789 and FM Global standard for indicator posts.
 - 2. Type: Underground.
 - 3. Base Barrel Material: Cast or ductile iron.
 - 4. Extension Barrel: Cast or ductile iron.
 - 5. Cap: Cast or ductile iron.
 - 6. Operation: Wrench.

2.7 TRIM AND DRAIN VALVES

- A. Angle Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fire Protection Products, Inc.
 - b. NIBCO INC.
 - c. United Brass Works, Inc.
 - 2. Description:
 - a. Pressure Rating: 175 psig.
 - b. Body Material: Brass or bronze.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

- A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
 - 1. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.
- H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.
- I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION 210523

SECTION 210548 - SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Seismic bracing shall comply with all applicable requirements of the 2018 International Building Code (IBC) including all applicable provisions 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. Fire sprinkler systems shall be braced in accordance with the requirements of NFPA 13 as is allowed by ASCE Standard 7-16 Sections 13.6.8.2 and 13.6.8.3.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.
 - 1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by a N.I.C.E.T. (National Institute for Certification in Engineering Technologies) Level III fire sprinkler technician or qualified State of Nevada Professional Engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: N.I.C.E.T Level III fire sprinkler technician or professional engineer.
- B. Welding certificates.
- C. The Contractor shall provide the required number of seismic shop drawing submittal sets for review and approval by the Owner. Submittals shall include a comprehensive set of shop drawings clearly depicting the seismic bracing requirements for all fire sprinkler suppression piping and equipment.
- D. 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 N.I.C.E.T Level III fire sprinkler technician or professional engineer.
- E. Seismic shop drawing submittals will be reviewed by both the mechanical engineer and the structural engineer.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PERFORMANCE REQUIREMENTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: D.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: wet-side components: 2.5.
 - c. Component Amplification Factor: 1.0 for wet-side components.
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 100.
 - 4. Design Spectral Response Acceleration at 1-Second Period: 60.
- B. Verify seismic restraint criteria and other requirements identified on the structural drawings or specifications.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- E. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- G. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.2 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
- B. END OF SECTION 210548

SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 - 2. Material and Thickness: anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
 - 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 5. Fasteners: Stainless-steel rivets.
 - 6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

3. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 6. Fasteners: Stainless-steel rivets.
 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brimar Industries, Inc.
 2. Craftmark Pipe Markers.
 3. LEM Products Inc.
 4. Marking Services Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- H. Fasteners: Stainless-steel rivets.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 LABEL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install or permanently fasten labels on each major item of mechanical equipment.
- D. Locate equipment labels where accessible and visible.
- E. Piping: Painting of piping is specified in Section 09 91 23 "Interior Painting."

- F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit a view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

END OF SECTION 210553

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

1.1 PERFORMANCE REQUIREMENTS

- A. Quality Standards: NFPA 13 and NFPA 70.

1.2 GENERAL REQUIREMENTS

- A. This is a performance specification and the contractor shall be responsible for providing all permits, fees, design, material, fabrication, storage, installation, and testing for a complete and operable fire sprinkler system.
- B. It is the fire protection contractor's responsibility to review all documents including (but not limited to) architectural, civil, electrical, plumbing, mechanical, and structural disciplines when designing the fire protection system. Fire protection contractor shall acknowledge on their shop drawings that they have reviewed all design documents as part of the preparation of the fire protection system design.
- C. System shall meet the requirements of national fire protection association (NFPA) 13, 24, the National Electrical Code (NEC), as well as local building officials, water department and state fire marshal requirements as applicable.
- D. Submit complete set of shop drawings including necessary calculations and catalog cuts of materials to the engineer and the authority having jurisdiction for approval. Obtain approval prior to installation. Drawings and calculations shall be certified by a minimum N.I.C.E.T. (national institute for certification engineering technology) fire sprinkler systems level III technician.
- E. System shall be hydraulically designed. Contractor shall obtain latest water supply information and determine sprinkler head spacing and design densities for hydraulic calculations. Required system pressure shall be a minimum of 10 P.S.I. below the available pressure at system demand.
- F. Plans for installation of any fire alarm, or fire sprinkler system shall be submitted under separate permit by contractors licensed by the Nevada State Fire Marshal's Office to do this work; a separate permit is required for each type of system.
- G. Contractor shall hold a valid Nevada contractor's license for the type of work being performed.
- H. All piping shall be suspended and braced in strict accordance with NFPA 13, 2012 IBC, and ASCE 7.
- I. The contractor guarantees that all work installed shall be free of all defects in workmanship and material for a period of one year from the date of the certification of completion and acceptance of work.
- J. After system is completely installed, it shall be filled and tested in accordance with local requirements, NFPA 13, and the requirements of the applicable NFPA bulletins.

- K. All sprinkler heads to be semi-recess type with escutcheon. Coordinate with architect on head and escutcheon colors. All piping is to be concealed above finish ceiling areas. Sprinkler heads shall be aligned with lights, diffusers, and other equipment so as to present a neat and symmetric appearance. Sprinkler heads to be centered in ceiling tile.
- L. In lieu of rigid pipe offsets or return bends for sprinkler drops, multiple-use flexible stainless-steel sprinkler drop system may be used to locate sprinklers as required by final finished ceiling tiles and walls. The drop system shall consist of a braided or unbraided (corrugated) type 304 stainless steel flexible tube, a zinc plated steel 1" NPT male threaded nipple for connection to branch line piping, and a zinc plated steel reducer with a 1/2" or 3/4" NPT female thread for connection to the sprinkler head. The braided drop system shall be FM approved for sprinkler services to 200 psi and can be installed without the use of tools, and the corrugated system shall be UL listed for sprinkler services to 175 psi. All hoses shall be factory-pressure tested to 400 psi.
- M. Freeze protection shall be provided for fire sprinklers and piping that protect the indicated overhangs containing combustible materials. The most appropriate method of freeze protection shall be determined by the fire protection contractor.
- N. Where fire protection piping crosses a building seismic expansion joint, the fire protection piping shall be provided with a flexible piping loop. Metraflex Fire Loop expansion joint, or approved equal, capable of accommodating movement in all directions up to 4 inches. Expansion joint shall be UL listed and FM approved.

END OF SECTION 211313

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Equipment installation requirements common to equipment sections.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.
- B. Company welding procedures.
- C. See section 013000 for submittal requirements.

1.4 QUALITY ASSURANCE

- A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- B. Reference Building Codes and Standards:
 - 1. IBC – 2018 International Building Code
 - 2. UMC – 2018 Uniform Mechanical Code
 - 3. UPC – 2018 Uniform Plumbing Code
 - 4. IFC – 2018 International Fire Code

5. NFPA – National Fire Protection Association
6. NEC – National Electrical Code
7. Nevada State Regulatory Agencies
8. ANSI – American National Standards Institute
9. SMACNA – Sheet Metal and Air Conditioning Contractors National Association
10. ASME – American Society of Mechanical Engineers
11. UL – Underwriters Laboratory
12. 2018 – International Energy Conservation Code

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

END OF SECTION 220500

SECTION 220516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

1.1 SUMMARY

- A. Section Includes:
 - 1. Packless expansion joints.
 - 2. Alignment guides and anchors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Warranty Information.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.2 PACKLESS EXPANSION JOINTS

- A. Flexible-Hose Packless Expansion Joints:
 - 1. Basis-of-Design Product, subject to compliance with the specified product on the drawings, provide a product by one of the following manufacturers:
 - a. Twin City Hose.
 - b. Engineered Hose.
 - c. Flex-Hose.
 - d. Or Approved Equal.
 - 2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, V-shaped bend or center section of flexible hose.
 - 3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
 - 4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.

- a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
 - b. Hoses on domestic hot water, cold water, and hot water return shall be NSF-61, Lead-Free compliant.
5. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon steel fittings with threaded end connections.
 - a. Stainless steel hoses and single-braid, stainless steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
 - b. Joints used for natural gas shall be UL-listed for natural gas use.
6. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon steel fittings with flanged end connections.
 - a. Stainless steel hoses and single-braid, stainless steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

2.3 ALIGNMENT GUIDES AND ANCHORS

- A. Alignment Guides:
 1. Guides shall be manufactured by the flexible hose manufacturer.
 2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.
- B. Anchor Materials:
 1. Steel Shapes and Plates: ASTM A36/A36M.
 2. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
 3. Washers: ASTM F844, steel, plain, flat washers.
 4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Stud: Threaded, Stainless steel.
 - b. Expansion Plug: Stainless steel.
 - c. Washer and Nut: Stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION JOINTS - GENERAL

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.

3.2 INSTALLATION OF ALIGNMENT GUIDES AND ANCHORS

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install one guide on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe, and secure guides to building structure.
- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

- E. Anchor Attachments:
 - 1. See structural drawings for anchor attachment specifications.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - 1. See structural drawings for anchor attachment specifications.

3.3 INSTALLATION OF PIPE LOOP AND SWING CONNECTIONS

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

END OF SECTION 220516

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements
- B. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron wall pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-steel wall pipes: ASTM A53/A53M, Schedule 40, with plain ends and welded steel collar: zinc coated.
- C. Galvanized Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- E. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufactureres: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Pipeline Seal and Insulator, Inc.
 - c. Or approved equal.
- B. Descriptions: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - a. Sealing Elements: EPDM – rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Stainless steel.
 - c. Connecting bolts and nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space

between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6 Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6 Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6 Steel pipe sleeves.

END OF SECTION 220517

SECTION 220518- ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

- e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
 - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
 - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping: One-piece, floor-plate type.
- E. Seal Escutcheons to wall with silicone suitable for use for kitchen and bathroom. Color of silicone used to be selected by architect.
- 3.2 FIELD QUALITY CONTROL
- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Miljoco Corporation.
 - 2. Terice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. Weksler Glass Thermometer Corp.
- B. Standard: ASME B40.200.
- C. NSF – 61 compliant.
- D. Case: sealed type(s); stainless steel with 5-inch nominal diameter.
- E. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- F. Connector Type(s): Union joint, adjustable angle and rigid, bottom, with unified-inch screw threads.
- G. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- H. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

- I. Window: Plain glass.
- J. Ring: Stainless steel.
- K. Element: Bimetal coil.
- L. Pointer: Dark-colored metal.
- M. Accuracy: Plus, or minus 1 percent of scale range.

2.2 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - 3. Material for Use with Copper Tubing: CNR or CUNI.
 - 4. Material for Use with Steel Piping: CRES.
 - 5. Type: Stepped shank unless straight or tapered shank is indicated.
 - 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
 - 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
 - 8. Bore: Diameter required to match thermometer bulb or stem.
 - 9. Insertion Length: Length required to match thermometer bulb or stem.
 - 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
 - 12. NSF-61 Compliant
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.
- C. NFS-61 compliant.

2.3 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Miljoco Corporation.
 - b. Terice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - d. Weksler Glass Thermometer Corp.
 - 2. Standard: ASME B40.100.
 - 3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 - 8. Pointer: Dark-colored metal.

- 9. Window: Glass.
- 10. Ring: Metal.
- 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- 12. NSF – 61 compliant.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
- K. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.

L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
1. Sealed, bimetallic-actuated type.

B. Thermometers at inlet and outlet of each tempering valve inlets and outlets shall be the following:
1. Sealed, bimetallic-actuated type.

C. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F.

B. Scale Range for Domestic Hot-Water and Tempered Water Piping: 0 to 250 deg F.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:
1. Sealed, direct-mounted, metal case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
1. Sealed, direct-mounted, metal case.

C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
1. Sealed, direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi.

B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION 220519

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Bronze ball valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
1. ASME B1.20.1 for threads for threaded end valves.
 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 3. ASME B16.18 for solder-joint connections.
 4. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
1. Include 2-inch stem extensions.
 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

- A. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- B. Two-Piece, Bronze Ball Valves with Full Port and Bronze or Brass Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milwaukee Valve.
 - b. NIBCO INC.
 - c. Red-White Valve Corporation.
 - d. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: Two piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded and soldered.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel.
 - i. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 4 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.3 DOMESTIC WATER VALVE SCHEDULE

- A. Pipe NPS 4 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
- B. Ball valves at expansion tanks shall be Bronze Ball Valves with lockable handles.

3.4 COMPRESSED AIR VALVE SCHEDULE

A. Pipe NPS 4 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

END OF SECTION 220523.12

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze check valves.
 - 2. Iron check valves for compressed air

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 Annex G and NSF 372.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE CHECK VALVES

- A. Bronze, inline, center guided silent check valve (1/4" through 2 1/2"):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. NIBCO INC.
 - b. Red-White Valve Corporation.
 - c. Watts; a Watts Water Technologies company.

- d. Milwaukee Valve.
- 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Threaded or soldered. See valve schedule articles.
 - f. Disc: Bronze.

2.3 IRON CHECK VALVES FOR COMPRESSED AIR

- A. Ductile Iron, globe type, center guided, silent check valve (2-1/2" through 8"):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Titan Flow Control
 - b. Crane; Crane Energy Flow Solutions.
 - c. Hammond Valve.
 - d. NIBCO INC.
 - e. Red-White Valve Corporation.
 - f. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. WOG (non-shock): 250 psig 100 deg. F.
 - b. Body Design: Inline flow.
 - c. Body Material: Ductile Iron ASTM A536
 - d. Ends: ANSI Class 150 flanged ends, flat face.
 - e. Disc: Aluminum Bronze ASTM B148
 - f. Seat: Aluminum Bronze ASTM B148
 - g. Spring: Series 300 Stainless Steel

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow in horizontal position with hinge pin level.

3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Pump-Discharge Check Valves:
 - a. NPS 2-1/2 and Smaller: Bronze non-slam check valves with bronze disc.
- B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- C. End Connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
 - 2. For Copper Tubing, NPS 2-1/2 threaded.

3.4 DOMESTIC WATER VALVE SCHEDULE

- A. Pipe NPS 2-1/2 and Smaller: Bronze non-slam check valves, Class 125, bronze disc with soldered or threaded end connections.

3.5 COMPRESSED AIR VALVE SCHEDULE

- A. Pipe NPS 2-1/2 and Smaller: Bronze non-slam check valves, Class 125, bronze disc with soldered or threaded end connections.
- B. Pipe greater than NPS 2-1/2: Iron non-slam check valves.

END OF SECTION 220523.14

SECTION 220529-HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified State of Nevada Professional Engineer, using performance requirements and design criteria indicated.
- 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/SEI 7.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified State of Nevada Professional Engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

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.

PART 2 - PRODUCTS

2.1 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: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer 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 washer made of stainless steel.
- C. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, 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.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 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.

2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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-69 and MSS SP-89. 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 fabricated from ASTM A 36/A 36M, 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 Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- 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, NPS 2-1/2 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. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 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.

3.2 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.

3.3 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 3/4 inches.

3.4 PAINTING

- A. Retain first paragraph below if Section 099113 "Exterior Painting" or Section 099123 "Interior Painting" is not in Project Manual.
- B. 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.
- C. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting", Section 099123 "Interior Painting", and Section 099600 "High-Performance Coatings." Retain first paragraph below if Section 099113 "Exterior Painting" or Section 099123 "Interior Painting" is in Project Manual. Revise reference if Section 099600 "High-Performance Coatings" applies instead.
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 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 and metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for stainless-steel piping and tubing.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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 noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- K. 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 NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. 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 deg F piping installations.
- M. 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-joint 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. 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 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. 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.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. 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.
- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners instead of building attachments where required in concrete construction.
- R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548-VIBRATION AND SEISMIC CONTROLS FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Seismic bracing for plumbing systems (equipment, piping, and conduit) shall comply with all applicable requirements of the 2018 International Building Code (IBC) including all applicable provisions 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. Compliance with the applicable seismic bracing requirements shall be accomplished utilizing the most current version of one of the following design manuals (no exceptions):
 - 1. International Seismic Application Technology (ISAT) Design Manual
 - 2. Mason Industries Seismic Restraint Design Manual
 - 3. Kinetics Noise Control Seismic Design Manual
 - 4. Vibro-Acoustics Seismic Design Manual
- C. A complete bound copy of the applicable design manual shall be provided to the Owner at the beginning of the construction period for use/reference during the course of the project.
- D. Component Importance Factors (I_p) for all plumbing equipment, piping, and conduit shall be determined and assigned in accordance with ASCE Standard 7-16 Section 13.1.3.

1.2 SUBMITTALS

- A. The Contractor shall provide the required number of seismic shop drawing submittal sets for review and approval by the Owner. Submittals shall include a comprehensive set of shop drawings clearly depicting the seismic bracing requirements for all plumbing equipment, piping, and conduit. Any equipment that does not require seismic bracing shall be specifically identified in the submittal, and the reason for exemption shall be provided.
- 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 mechanical, structural, or civil engineer licensed in the State of Nevada.
- C. Seismic shop drawing submittals will be reviewed by both the mechanical engineer and the structural engineer.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. 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. A minimum of three site visits shall be provided, with the first visit scheduled just prior to installation of the first seismic braces, the second visit at the approximate midpoint of construction, and the third visit when the seismic bracing installation is complete (and prior to installation of ceilings).
- D. A written report shall be issued within one week of each site visit summarizing the observations made during the site visit and listing all required corrective actions and/or deficiencies.
- E. Site visits shall be coordinated with the Owner and shall be scheduled in writing a minimum of two weeks prior to the proposed site visit date.
- F. 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.

1.5 SPECIAL INSPECTION

- A. Special inspections will be arranged and paid for by the Owner when and if required by 2018 IBC Section 1704. When special inspection is required for a system or item of equipment the Contractor shall be available on site during each special inspection to facilitate the on-site review process.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 140 mph.
 - 2. Building Classification Category: III.

3. Minimum 10 lb./sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.
- B. Seismic-Restraint Loading:
1. Site Class as Defined in the IBC: D.
 2. Assigned Seismic Risk as Defined in the IBC: III.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 6.0 for air-side units and ducts of sheet metal; wet-side components: 2.5.
 - c. Component Amplification Factor: 2.5 for air-side components and 1.0 for wet-side components.
 3. Design Spectral Response Acceleration Parameter at Short Periods (0.2 Second): 1.577g.
 4. Design Spectral Response Acceleration Parameter at 1-Second Period: 0.841g.

2.2 SEISMIC RESTRAINTS

- A. Compliance with the applicable seismic bracing requirements shall be accomplished utilizing the most current version of one of the following design manuals (no exceptions):
1. International Seismic Application Technology (ISAT) Design Manual
 2. Mason Industries Seismic Restraint Design Manual
 3. Kinetics Noise Control Seismic Design Manual
 4. Vibro-Acoustics Seismic Design Manual

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Installation of vibration isolators must not cause any change of position of equipment, piping resulting in stresses or misalignment.
- B. Equipment Restraints:
1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- C. Piping Restraints:
1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach

equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test to 90 percent of rated proof load of device.
5. Measure isolator restraint clearance.
6. Measure isolator deflection.
7. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Valve Tags
 4. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
 3. Letter Color: White.
 4. Background Color: Black.
 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 8. Fasteners: Stainless-steel rivets.
 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the

Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. Material and Thickness: 2-inch diameter, 1/8-inch-thick brass, and having predrilled hole.
- C. Top row shall indicate system connected to
- D. Bottom row shall be a unique number

- E. Provide owner with a schedule of valve numbers and locations of valves.

2.4 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

PART 3 - EXECUTION

3.1 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.
- C. Equipment label schedule:
 - 1. Plastic Name Tag
 - 2. Label the following equipment:
 - a. Water heater
 - b. Expansion tank
 - c. Air compressor
 - d. Storage tank

3.2 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:

1. Sanitary Waste and Vent Piping: Black letters on a green background.
2. Drain Piping: White letters on a safety-green background.
3. Domestic Cold Water: White letters and blue background.
4. Industrial Cold Water: White letters and yellow background.
5. Domestic Tempered Water: White letter and red background.
6. Domestic hot water: White letters and red background.
7. Domestic hot water return: White letters and orange background.
8. Natural gas: Black letters on safety-yellow background.
9. 75W-90W Oil: Black Letters on Safety-Yellow Background
10. 80W-140W Oil: Black Letters on Safety-Yellow Background
11. 15W-40W Oil: Black Letters on Safety-Yellow Background
12. Lube: Black Letters on Safety-Yellow Background
13. Compressed Air: Black Letters on Safety-Yellow Background

END OF SECTION 220553

SECTION 220719 PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Domestic tempered-water piping.
 - 5. Domestic recirculating, tempered-water piping.

1.2 ACTION SUBMITTALS

- A. See Section 013300 for submittal requirements.
- B. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Flexible Closed Cell Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
 - 2. Insulation shall be an EPDM-rubber based insulation that is UV resistant. Insulation shall not require supplemental vapor retarder protection. Insulation shall have an acrylic adhesive seal on the inside of the longitudinal joint and an EPDM flap that is self-sealing.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall 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."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.

- c. Foster Brand; H. B. Fuller Construction Products.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall 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. PVC Jacket Adhesive: Compatible with PVC jacket
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. P.I.C. Plastics, Inc.
 - d. Speedline Corporation.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall 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."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall 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."
 - 4. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 5. Adhesive shall 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."
- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
2. Water-Vapor Permeance: ASTM F1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall 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."

B. FSK and Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall 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."

C. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: White.
 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealants shall 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."
- C. Flexible Elastomeric Insulation Sealants:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Sealants shall 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."

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 3. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricated.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

- C. Aluminum embossed jacket, 0.016" thick
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricated.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136
 - 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. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc., an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Compac Corporation.
 - b. Ideal Tape Co., Inc., an American Biltrite Company.
 - c. Venture Tape.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500 percent.
 - 6. Tensile Strength: 18 lbf/inch in width.

2.8 SECUREMENTS

- A. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch-thick, 1/2-inch-wide with wing seal or closed seal.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel, or Monel.

- C. Wire: 0.080-inch nickel-copper alloy.
 - 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. C & F Wire.

PART 3 EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078400 - Firestopping for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 - Firestopping.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets,

- valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.5 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water: Insulation shall be the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- B. Domestic Hot and Recirculated Hot Water: Insulation shall be the following:
 - 1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- C. Domestic Tempered and Recirculated Tempered water: Insulation shall be the following:
 - 1. Mineral-Fiber, preformed pipe insulation, Type 1: 1-inch thick.

3.10 OUTDOOR PIPING INSULATION SCHEDULE

- A. Industrial Cold Water and Drain Piping from Make-up Air Unit: Insulation shall be the following:
 - 1. Flexible Elastomeric, Preformed Pipe Insulation, Type I: 1-inch thick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
- D. Piping, Exposed in the office area:
 - 1. PVC: 30 mils thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping Industrial Cold Water and Drain Piping to and from Make-up Air Unit:

1. Aluminum Embossed Jacket: 0.016-inches thick.

END OF SECTION 220719

SECTION 220800 – PLUMBING SYSTEMS COMMISSIONING

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED WORK

- A. All other sections in Division 21, 22, and 23.
- B. Specification Section 019133 -- “General Commissioning Requirements.”
- C. Specification Section 260800 - “Electrical Systems Commissioning
- D. Specification Section 230800 – “HVAC Systems Commissioning”.

1.2 DEFINITIONS

- A. The purpose of the commissioning process is to provide the Owner/operator of the facility with a high level of assurance that the plumbing systems have been installed in the prescribed manner, and operates within the performance guidelines set in the design intent. The Commissioning Authority (CxA) shall provide the Owner with an unbiased, objective view of the system 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.

1.3 SCOPE

- A. The Plumbing 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 Owners’ project requirements (ORP) and the Construction Documents (CD). The commissioning process shall demonstrate that each piece of equipment is performing and operating to the OPR and CDs.
- B. Participants in Plumbing Systems Commissioning: plumbing systems shall be conducted with representatives from the following entities (the required participants shall be confirmed with the commissioning agent prior to scheduling the commissioning).
 - 1. General Contractor
 - 2. Plumbing Contractor
 - 3. Owner’s Representative
- C. Major Pieces of Equipment shall be defined as (while this list is meant to show a representative sample, any equipment that uses energy for heating water or moving water shall be considered as major):
 - 1. Water Heaters
 - 2. Domestic Water Recirculation Pumps

3. Tempering Valve
 4. Air Compressor System.
- D. Kickoff, Coordination and MEP Meetings.
1. The CxA will attend the contractors sub meeting to discuss any issue items.
 2. Other meetings such as the Commissioning Kick-Off meeting, controls meeting, another coordination meetings shall be attended by those participants as indicated in the “Participants in Plumbing Systems commissioning.”
- E. Submittal Review and Meetings.
1. The CxA shall review each submittal in Division 22.
 2. Submittal reviews are NOT an approval but a courtesy review to help validate products submitted are in general compliance with the construction documents.
- F. Issues Log.
1. An “Issues Log” shall be kept by the CxA. The issues log will identify issues, defects, improper installations, and deficiencies of the installation and design. The issues log will have the issue, a potential resolution, the subcontractor responsible, the date the issue was found, and the CxA who found the issue.
 2. The issue log shall be immediately addressed every week by the contractor.
 3. When an item is completed and addressed by the contractor or subcontractor 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.
- G. Construction Checklists: Pre-and Final Functional testing checklist, and startup checklists:
1. The CxA shall develop construction checklists that will be executed by the CxA. The contractors and sub-contractors shall review the checklists for compliance with the ability of their individual systems. If the contractor or subcontractor does 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 subcontractor has not in writing opposed such test, then the contractor or subcontractor shall be liable for any damages and delays.
 2. The contractor shall fill out checklists and Contractor Readiness Checklists (CRC). These shall be delivered in the commissioning plan and shall be used to show the CxA that the contractor is ready for Final Commissioning (FAT.)
 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 Plumbing 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 the addressed in writing prior to requesting a date for the recommissioning. 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.

1.4 SYSTEMS TO BE COMMISSIONED

- A. This list is not intended to be exhaustive. All Division 22 and any equipment, piping, balancing, controls, etc. that are defined in the entire cumulative sections of Division 22 will go through commissioning. The list below is a representative sample of items that are typically commissioned.
 - 1. Domestic water piping and equipment.
 - 2. Plumbing fixtures.
 - 3. Mixing valves.
 - 4. DWV piping.
 - 5. Natural gas piping.
 - 6. Compressed air storage tanks.
 - 7. Compressed air and equipment.
 - 8. Chlorination proceeds.

1.5 COORDINATION

- A. The Commissioning Authority shall receive a copy of all construction documents, addenda, change orders, and appropriate approved submittals and show drawings directly from the Contractor. We only use this documentation for our review, but 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 the progress, pending problems and/or disputes, and shall provide regular status reports on the progress with each system. Any potential change in the contractual and/or financial obligations of the Owner (credit, change orders, schedule changes, etc.) shall be identified and qualified as soon as possible.
- D. The Commissioning Authority shall coordinate the schedule of commissioning activities with the construction schedule. It is possible that procedures will be completed before the entire plumbing system is completed.

1.6 SCHEDULE

- A. Final commissioning shall not commence on the individual pieces of equipment, test and balance controls, and other plumbing systems until the Contractor Readiness Checklist are delivered to the CxA. These checklists will be done in blocks coordinated with the contractor.
- B. Pre-Functional Commissioning shall commence during the progress of the project. Contractor Readiness checklists 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 coordinate commissioning scheduling information with the contractor for review and planning activities.
- D. The following list is a general set of tasks and criteria along with the approximate duration for each task in regards to the CxA activities. This list is intended to be utilized as a guideline for creating an appropriate schedule for all of the work related to plumbing systems commissioning. Three of these activities can be commissioned concurrently at one time. The activities do not include issues that will take additional days to fix.
 - 1. Plumbing fixtures – 2 business days.
 - 2. Domestic hot-water system – 2 business days.
 - 3. Domestic cold-water systems – 2 business days.
 - 4. Compressed Air System – 2 business days.

1.7 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 the interpretation of construction and documentation, the final responsibility rests solely on the General and Installation Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 COMMISSIONING KICKOFF MEETING

- A. The CxA shall facilitate a Commissioning Kick-off Meeting after all plumbing, electrical, and plumbing subcontractors are under contract with the General Contractor. The CxA shall invite the Architect, Engineers, and Owner's 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 Plumbing 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 in attendance.

3.2 DISTRIBUTION LIST

- A. A distribution list shall be developed during the Commissioning Kick-off 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 subcontractors by the CxA, the sole responsibility for the subcontractors to receive information rests 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 checklists, the FAT checklists, and the Contractor Readiness checklists.
- C. The subcontractors and contractors are responsible for reviewing the above checklists and provide comments to the CxA within 30 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 subcontractors to ensure the safety of systems.

3.4 SUBMITTAL REVIEWS

- A. The CxA shall review all plumbing submittals. It is the responsibility of the contractor to ensure they receive the CxA reviews. The Architect is responsible to coordinate the submittals with the CxA,
- B. The submittals will be marked with REVIEWED as noted. Refer to Engineer, reviewed with the Engineer, Note, or Revise and Resubmitted. Only Revise and Resubmit items will have the expectation of a re-submittal.

3.5 COORDINATION MEETING (MEP MEETINGS)

- A. The CxA shall attend the contractors MEP meeting every other week.
- B. The purpose of these meeting is to coordinate installation, commissioning, and testing activities. These meeting will be conducted by the contractor.

3.6 CONSTRUCTION OBSERVATION AND FIRST INSTALLS

- A. The CxA shall observe construction activities throughout the construction of the project. Schedule observations and coordinate with GNC. 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 shall be required by the contractor and subcontractor for the following items:
 - 1. Piping and Hangers (Racks of pipes and individual pipes.)
- C. Contractor shall coordinate and not prohibit observations and first installs. Subcontractors, Owner's representatives, and engineers shall review the First installs for compliance.

3.7 CONTRACTORS READINESS CHECKLIST

- A. Contractor Readiness Checklist (CRC) shall be delivered to the CxA to the contracting team for the contracting team to complete. The purpose of the CRC is to inform the

CxA of the readiness of the contractor to begin Functional Testing on the plumbing system.

- B. The CxA shall not Function Test the system or any equipment until the CRCs have been 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 completed for 80 heat pumps.)

3.8 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 developed by the contractors and subcontractors and shall be executed by the CxA and delivered in the commissioning plan
- C. The CxA shall review 100% of all plumbing system installations.

3.9 FUNCTIONAL ACCEPTANCE TESTING

- A. The CxA shall execute Functional Acceptance Testing.
- B. Commissioning Authority shall develop and document the commissioning procedures to be used; tis will be delivered to the contractor in the commissioning plan and is called the Procedural Standards. Included is 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 subcontractors for technical dept, clarity of documentation completeness of information. Emphasis shall be placed on testing procedures that shall determine actual systems performance and compliance with the design intent.
- C. The Commissioning Authority shall determine the acceptance procedures for each system within MEP divisions as required. The acceptance procedures shall incorporate the commissioning standards and successful testing results as referred to throughout plumbing 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 procedure 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, work as intended, is correctly documented, and operator training has been performed.

- F. The BMS or ATC contractor shall be in attendance throughout the Sequence of Operation checks, which we expect to take 1 day if all sequences function as per contract documents.

- G. The CxA shall review 100% and test 100% of plumbing systems.

3.10 OPERATION MAINTENANCE MANUALS

- A. 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.
- B. The final O&M must be delivered to the Owner before training shall commence and it shall be one of the requirements for Substantial Completion.

3.11 TRAINING

- A. The CxA shall be invited to all plumbing 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 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 philosophy, troubleshooting and repair techniques.

3.12 RECORD DRAWINGS OR REDLINES

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

- B. Record Drawings or Redlines shall be kept in a printed format above and beyond any BIM modeling. If record drawings are being kept on BIM a printed 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 met for Redlines or Record Drawings:
 - 1. Per specifications elsewhere defined.
- D. The final redlines shall be reviewed by the CxA before delivery to the Architect.

3.13 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.

3.14 REPEATED WORK, TESTING, AND REVIEWS

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

END OF SECTION 220800

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8-inch-thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

- A. General Requirements:
 1. Same size as pipes to be joined.
 2. Pressure rating at least equal to pipes to be joined.
 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HART Industrial Unions, LLC.
 - b. Watts.
 - c. Wilkins.
 - d. Zurn Industries, LLC.
 2. Standard: ASSE 1079.
 3. Pressure Rating: 150 psig.
 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Watts.
 - b. Wilkins.
 - c. Zurn Industries, LLC.
 2. Standard: ASSE 1079.
 3. Factory-fabricated, bolted, companion-flange assembly.
 4. Pressure Rating: 150 psig.

5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 2. Nonconducting materials for field assembly of companion flanges.
 3. Pressure Rating: 150 psig.
 4. Gasket: Neoprene or phenolic.
 5. Bolt Sleeves: Phenolic or polyethylene.
 6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Grinnell Mechanical Products.
 - b. Precision Plumbing Products.
 - c. Victaulic Company.
 2. Standard: IAPMO PS 66.
 3. Electroplated steel nipple complying with ASTM F 1545.
 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
 5. End Connections: Male threaded or grooved.
 6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install shutoff valve immediately upstream of each dielectric fitting.

- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- G. Install domestic water piping level and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
- T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install supports for vertical steel piping every 15 feet.
- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 - 2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
- 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Aboveground domestic water piping, NPS 1-1/2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
- E. Aboveground domestic water piping, NPS 2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints

END OF SECTION 221116

SECTION 221117 - DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes equipment drain pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type M water tube, drawn temper.
- B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- C. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.

2.3 CPVC PIPING.

- A. CPVC Pipe:
 - 1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.4 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys.
- B. Flux: ASTM B 813, water flushable.

- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Solvent Cements for Joining CPVC Piping and Tubing:
 - 1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Solvent cement and adhesive primer shall 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."

2.5 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Plastic-to-Metal Transition Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO INC.
 - c. Spears Manufacturing Company.
 - 2. Description:
 - a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. HART Industrial Unions, LLC.
 - b. Watts.
 - c. Wilkins.
 - d. Zurn Industries, LLC.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 150 psig.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- E. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- I. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- J. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- K. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

- C. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
 - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 3. PVC Piping: Join according to ASTM D 2855.
- E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
 - 2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
- H. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- I. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
- J. Install supports for vertical PVC piping every 48 inches.
- K. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:
 - a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - b. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - c. Prepare reports for tests and for corrective action required.

B. Prepare test and inspection reports.

3.8 CLEANING

- A. Clean and flush piping of all debris, use a filter at the end of discharge so debris do not go into drains.

3.9 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Water heater drain piping to the neutralizer shall be the following:
 1. CPVC, Schedule 40, plastic pipe and fittings and solvent-welded joints
- E. Water heater drain from the neutralizer to the floor sink/drain shall be the following:
 1. Hard copper tube, ASTM B 88, Type M; wrought-copper, solder-joint fittings; and soldered joints.
- F. Equipment drain for mechanical equipment shall have a trap per manufacturer's instructions and be the following:
 1. Hard copper tube, ASTM B 88, Type M; wrought copper, solder-joint fittings, and soldered joints.
- G. Boiler condensate drain piping to and from the neutralizer shall be the following:
 1. CPVC, Schedule 40, plastic pipe and fittings and solvent-welded joints

END OF SECTION 221117

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backflow preventers.
2. Water pressure-reducing valves.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Hose bibbs.
6. Wall hydrants.
7. Water-hammer arresters.
8. Trap-seal primer device.

B. Related Requirements:

1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1.3 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A.** Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

1.6 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

PART 2 - GENERAL

2.1 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
1. Basis of design product. Provide product specified on drawings or a product by one of the following manufacturers:
 - a. Zam
 - b. Watts
 - c. Or approved equal
 2. Standard: ASSE 1013.
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: 12 psig maximum, through middle third of flow range.
 5. Body: Bronze for NPS 2 and smaller.
 6. Configuration: Designed for horizontal, straight-through flow.
 7. Accessories:
 - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.2 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators:
1. Basis of design product. Provide product specified on drawings or a product by one of the following manufacturers:
 - a. Zam
 - b. Watts
 - c. Or approved equal.
 2. Standard: ASSE 1003.
 3. Pressure Rating: Initial working pressure of 150 psig.
 4. Body: Bronze for NPS 2 and smaller; bronze for NPS 2-1/2 and NPS 3.
 5. Valves for Booster Heater Water Supply: Include integral bypass.
 6. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.

2.3 BALANCING VALVES

- A. Memory-Stop Balancing Valves:
1. Provide product compliant to the specifications by one of the following manufactures:
 - a. Bell and Gossett
 - b. Caleffi
 - c. Red and White Value Company
 - d. Nibco
 2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
 3. Pressure Rating: 400-psig minimum CWP.
 4. Size: NPS 2 or smaller.

5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass or stainless steel.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Basis of design product. Provide specified product or drawings or one of the listed manufacturers below. Subject to compliance with specified products:
 - a. Leonard
 - b. Symmons
 - c. Watts
 - d. Or approved equal.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed-mounted or Cabinet-type, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

2.5 HOSE BIBBS

A. Hose Bibbs:

1. Basis of design product. Provide product by the specified manufacturer or by one of the following manufacturers. Subject to compliance with specified products:
 - a. Woodford
 - b. Schier
 - c. Or approved equal
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Lockable handle.
12. Include operating key with each operating-key hose bibb.
13. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.6 WALL HYDRANTS

A. Freezeless Wall Hydrants:

1. Basis of design product. Provide product by the specified manufacturer or by one of the following manufacturers. Subject to compliance with specified products:
 - a. Woodford
 - b. Schier
 - c. Or approved equal
2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.
7. Outlet, exposed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Nozzle and Wall-Plate Finish: Chrome.
9. Operating Keys(s): Two with each wall hydrant.

2.7 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Basis of design product, subject to compliance with product specified on drawings or provide product by one of the following manufacturers:
 - a. MiFab
 - b. Zurn
 - c. Watts
 - d. Sioux Chief
 - e. Or approved equal
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.
5. Manufacturers' written instructions shall not require an access door.

2.8 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Basis of design product, subject to compliance with specified product. Provide product by one of the following:
 - a. PPP Inc.
 - b. Or approved equal.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Basis of design product, subject to compliance with specified product. Provide product by one of the following:
 - a. PPP Inc.
 - b. Or approved equal.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

- A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- B. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.
- C. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Y-Pattern Strainers: For water, install on supply side of each water pressure-reducing valve.
- E. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
- F. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- G. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- H. Install refrigerator supply boxes flush with wall and level.

3.2 PIPING CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.
- D. Adjust each reduced-pressure-principle backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections.
 - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. In-line, sealless centrifugal pumps.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- 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.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grundfos Pumps Corp.
 - 2. TACO Incorporated.
 - 3. Or approved equal.
- B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- C. Pump Construction:
 - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
 - 2. Casing: Bronze, with threaded or companion-flange connections.
 - 3. Impeller: Plastic.
 - 4. Motor: Single speed, unless otherwise indicated.

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 CONTROLS

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
 - 1. Type: Water-immersion temperature sensor, for installation in piping.
 - 2. Range: 65 to 200 deg F.
 - 3. Enclosure: NEMA 250
 - 4. Operation of Pump: On or off.
 - 5. Transformer: Provide if required.
 - 6. Settings: Start pump at 105 deg F and stop pump at 110 deg F.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft horizontal.
- D. Install thermostats in hot-water return piping.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - b. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."
 - 2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," "Section 220523.14

"Check Valves for Plumbing Piping," and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."

3. Install pressure gage and snubber at suction of each pump and pressure gage and snubber at discharge of each pump. Install at integral pressure-gage tapings were provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

- D. Connect thermostats to pumps that they control.

3.3 ADJUSTING

- A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

SECTION 221124 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.
 - 5. Pressure regulators.
 - 6. Earthquake valves.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified State of Nevada Professional engineer, using performance requirements and design criteria indicated.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Delegated-Design Submittal: For natural-gas piping and equipment 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. Detail fabrication and assembly of seismic restraints.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Steel Support 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.
- C. 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.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
 - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

2.2 PIPING SPECIALTIES

- A. Flexible Hose Connectors:
 - 1. Flexible hose connector to accommodate any thermal expansion, contraction, or seismic movement of the connected equipment.
 - 2. Capable of compensating for lateral movement and vibration.
 - 3. Manufactured complete with section of corrugated metal hose, compatible braid, with inlet and outlet connections as required.
 - 4. CSA / AGA certified.
 - 5. Products:
 - a. Metraflex Company model GASCT, threaded ends
 - b. Metraflex Company model GASCW, flanged ends
 - c. Or approved equal.
 - 6. Corrugated Hose:
 - a. Type 304 stainless steel.
 - 7. Braid:
 - a. Type 304 stainless steel.
 - 8. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.

9. Flexible hose connector shall be rated with a 150psi minimum operating pressure.

B. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

C. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

D. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.**
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.**

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.**
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.**
1. CWP Rating: 125 psig.
 2. Threaded Ends: Comply with ASME B1.20.1.
 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.

4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Co.; a Masco company.
 - b. Conbraco Industries, Inc.
 - c. Nibco
 2. Body: Bronze, complying with ASTM B 584.
 3. Ball: Chrome-plated bronze.
 4. Stem: Bronze; blowout proof.
 5. Seats: Reinforced TFE; blowout proof.
 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 8. CWP Rating: 600 psig.
 9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- D. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A.Y. McDonald Mfg. Co.
 - b. Lee Brass Company.
 2. Body: Bronze, complying with ASTM B 584.
 3. Plug: Bronze.
 4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 5. Operator: Square head or lug type with tamperproof feature where indicated.
 6. Pressure Class: 125 psig.
 7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Solenoid Shut Off Valve:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ASCO.
 - b. Approved equal
 2. Body: Aluminum.
 3. Plug: 430F stainless steel.
 4. Ends: Threaded, socket,
 5. Pressure Class: 125 psig.

7. Listing: FM approved to Class 7400 "Liquid and Gas Safety Shutoff Valves".
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 EARTHQUAKE VALVES

- A. Earthquake Valves: Comply with ASCE 25.
 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. Pacific Seismic Products, Inc.
 - b. Or approved equal.
 2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 3. Maximum Operating Pressure: 60 psig.
 4. Cast-aluminum body with stainless-steel internal parts.
 5. Nitrile-rubber, reset-stem o-ring seal.
 6. Valve position, open or closed, indicator.
 7. Composition valve seat with clapper held by spring or magnet locking mechanism.
 8. Level indicator.
 9. End Connections: Threaded for valves NPS 2 and smaller.

2.6 PRESSURE REGULATORS

- A. General Requirements:
 1. Single stage and suitable for natural gas.
 2. Steel jacket and corrosion-resistant components.
 3. Elevation compensator.
 4. End Connections: Threaded for regulators NPS 2 and smaller.
- B. Line Pressure Regulators: Comply with ANSI Z21.80.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Meter Company.
 - b. Emerson Fisher.
 - c. Or Approved Equal.
 2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 11. Maximum Inlet Pressure: 5 psig.

2.7 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- D. Install fittings for changes in direction and branch connections.
- E. Install pressure gage downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."
- F. Exterior exposed gas piping to be painted with UV-resistant, 100% lead-free, paint. Paint is to be sampled and approved by WCSD.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use natural-gas piping as grounding electrode.
- T. Install pressure gage downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."
- U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

- V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.4 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

- B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 - 3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to kitchen appliances using manual gas shutoff valves, unions, and appliance connectors. Install valve within 72 inches of each gas-fired appliance. Install union between valve and appliances.
- E. Connect piping to equipment (boilers, water heaters, unit heaters, etc.) using manual gas shutoff valves, unions, and flexible connectors. Install valve within 72 inches of each gas-fired equipment. Install union between valve and equipment
- F. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.
- G. Flexible piping to unit to be full size of the rigid gas pipe not connection size of unit.

3.7 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

- B. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

- A. Aboveground, branch piping NPS 2 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Above ground piping greater than NPS2, shall be the following.
 - 1. Steel pip with welded fittings.
- C. Aboveground, distribution piping shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.
- D. All outdoor piping to be painted with UV resistance exterior paint to match existing building. Paint shall be 100% lead-free and be tested and approved by WCSD environmental department.

3.10 INDOOR PIPING SCHEDULE

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 2. Steel pipe with wrought-steel fittings and welded joints.

3.11 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service entrance shall be the following:
 - 1. Bronze plug valve.
- B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Valves in branch piping for single appliance shall be the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- D. FLEXIBLE PIPING APPLICATION SCHEDULE
 - 1. Rooftop Units: flexible hose connector.
 - 2. Boilers: flexible hose connector.
 - 3. Water heaters: flexible hose connector.
 - 4. Kitchen appliances: appliance flexible connector.

END OF SECTION 221124

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. See section 013300 for submittal requirements.

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Heavy-Duty, Hubless-Piping Couplings:
 - Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. MiFab, Inc.
 - c. Tyler Pipe.
 - d. Or approved equal.
- C. Standards: ASTM C 1277 and ASTM C 1540.
- D. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back-to-back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
 - Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.

Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- M. Plumbing Specialties:
 - Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 - Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors.
- P. Install sleeve seals for piping penetrations of concrete walls and slabs.
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 - Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 - Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 - Vertical Piping: MSS Type 8 or Type 42, clamps.
 - Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls.
 - Support pipe rolls on trapeze.
 - Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

- E. Maximum spans in remaining paragraphs were taken from MSS SP-69 for water service and from model plumbing codes. The most restrictive piping and spacing dimensions allowed are shown.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - NPS 3: 60 inches with 1/2-inch rod.
 - NPS 4: 60 inches with 5/8-inch rod.Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.

3.3 CONNECTION

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 - Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

3.4 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

Prepare reports for tests and required corrective action.

3.6 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.7 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, vent piping NPS 4 and smaller shall be the following:
Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
- C. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

END OF SECTION 221316

SECTION 221319 -SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Miscellaneous sanitary drainage piping specialties.

1.2 ACTION SUBMITTALS

- A. See Section 013300 for submittal requirements.
- B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 PRODUCTS

2.1 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts.
 - f. Zurn Industries, LLC.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk or raised-head, brass plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Floor Cleanouts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. Smith, Jay R. Mfg. Co.
 - c. Tyler Pipe.
 - d. Watts.
 - e. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Threaded, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.
 - d. Tyler Pipe.
 - e. Watts.
 - f. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round, wall-installation frame, and cover.

2.2 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch-minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

- F. Assemble open drain fittings and install with top of hub 2 inches above floor.
- G. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 - Sanitary Waste and Vent Piping for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 - Sheet Metal Flashing and Trim.

3.4 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 - Identification for Plumbing Piping and Equipment.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221319.13 - SANITARY DRAINS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Floor drains.
 - 2. Floor sinks.
 - 3. Trench drains.

1.2 DEFINITIONS

- A. HDPE: High-density polyethylene.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 DRAIN ASSEMBLIES

- A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

2.2 FLOOR DRAINS

- A. Cast-Iron Floor Drains:
 - 1. Basis of design product, subject to compliance with the special product on the drawings. Provide a product by one of the following manufacturers:
 - a. Zurn
 - b. MiFab
 - c. J.R. Smith
 - d. Or approved equal.
 - 2. Standard: ASME A112.6.3.
 - 3. Pattern: Floor drain.
 - 4. Body Material: Gray iron.
 - 5. Anchor Flange: Required.
 - 6. Outlet: Bottom.
 - 7. Sediment Bucket: Not required.
 - 8. Top Shape: Round.
 - 9. Trap Material: Cast iron.
 - 10. Trap Pattern: Standard P-trap.

2.3 FLOOR SINKS

- A. Cast-Iron Floor Sinks:
 - 1. Basis of design product, subject to compliance with the special product on the drawings. Provide a product by one of the following manufacturers:
 - a. Zurn

- b. MiFab
 - c. J.R. Smith
 - d. Or approved equal.
- 2. Standard: ASME A112.6.7.
- 3. Pattern: Floor drain.
- 4. Body Material: Cast iron.
- 5. Anchor Flange: Required.
- 6. Outlet: Bottom, no-hub, connection.
- 7. Coating on Interior Surfaces: Acid-resistant enamel.
- 8. Internal Strainer: Dome.
- 9. Internal Strainer Material: Aluminum.
- 10. Top Grate Material: Cast iron, loose.
- 11. Top of Body and Grate Finish: Acid-resistant enamel.
- 12. Top Shape: Square.

2.4 TRENCH DRAINS

- A. Trench Drains:
 - 1. Basis of design product, subject to compliance with the special product on the drawings. Provide a product by one of the following manufacturers:
 - a. Zurn
 - b. MiFab
 - c. J.R. Smith
 - d. Or approved equal.
 - 2. Standard: ASME A112.6.3 for trench drains.
 - 3. Material: Ductile or gray iron.
 - 4. Outlet: Bottom.
 - 5. Grate Material: Ductile iron.
 - 6. Grate Finish: Not required.
 - 7. Top Loading Classification: Class E.
 - 8. Trap Material: Cast iron.
 - 9. Trap Pattern: Standard P-trap.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 - 3. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
 - a. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install trench drains at low points of surface areas to be drained.
 - 1. Set grates of drains flush with finished surface, unless otherwise indicated.
 - 2. Install on support devices, so that top will be flush with adjacent surface.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 - Sanitary Waste and Vent Piping for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Comply with requirements in Section 221319 - Sanitary Waste Piping Specialties for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.
- C. Install piping adjacent to equipment to allow service and maintenance.

3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 221513 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes piping and related specialties for general-service compressed-air systems, as follows:
 - 1. Pipes, tubes, and fittings.
 - 2. Joining materials.
 - 3. Valves.
 - 4. Dielectric fittings.
 - 5. Flexible pipe connectors.
 - 6. Specialties.
 - 7. Quick couplings.
 - 8. Hose assemblies.
- B. Related Requirements:
 - 1. Section 221519 "General-Service Packaged Air Compressors and Receivers" for general-service air compressors and accessories.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Pipes, fittings, and valves.
 - 2. Dielectric fittings.
 - 3. Flexible pipe connectors.
 - 4. Safety valves.
 - 5. Pressure regulators. Include rated capacities and operating characteristics.
 - 6. Automatic drain valves.
 - 7. Filters. Include rated capacities and operating characteristics.
 - 8. Quick couplings.
 - 9. Hose assemblies.
- B. See specification section 013300.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Schedule 40, Steel Pipe: ASTM A53/A53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded in accordance with ASME B1.20.1.
 - 1. Steel Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.

3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
5. Wrought-Steel, Butt-Welding Fittings: ASME B16.9, Schedule 40.
6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.

- B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 VALVES

- A. Metal Ball, Butterfly, Check, and Gate Valves: Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

2.3 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
1. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 150 psig.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.4 FLEXIBLE PIPE CONNECTORS

- A. Stainless Steel-Hose Flexible Pipe Connectors: Corrugated, stainless-steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: 200 psig - 250 psig minimum.
 2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.

2.5 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Line Pressure Regulators, Bronze Body: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200 psig minimum inlet pressure, unless otherwise indicated.
- C. Air-Line Pressure Regulators, Aluminum Alloy, or Plastic Body: Diaphragm operated, aluminum alloy or plastic body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200 psig minimum inlet pressure, unless otherwise indicated.

- D. Automatic Drain Valves: Stainless steel body and internal parts, rated for 200 psig minimum working pressure, capable of automatic discharge of collected condensate.
- E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded

2.6 QUICK COUPLINGS

- A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- B. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless steel or nickel-plated-steel operating parts.
 - 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
 - 2. Plug End: Straight-through type with barbed outlet for attaching hose.
- C. Valveless Quick Couplings: Straight-through brass body with stainless steel or nickel-plated-steel operating parts.
 - 1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
 - 2. Plug End: With barbed outlet for attaching hose.

2.7 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300 psig minimum working pressure, unless otherwise indicated.
 - 1. Hose: Reinforced double-wire-braid, CR-covered hose for compressed-air service.
 - 2. Hose Clamps: Stainless steel clamps or bands.
 - 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
 - 4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Compressed-Air Piping between Air Compressors and Receivers: Use the following piping materials for each size range:
 - 1. NPS 2 and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.
- B. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:

1. Retain one of two subparagraphs below, or both NPS 2 and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.

C. Drain Piping: Use the following piping materials:

1. NPS 2 and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Article in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 and Section 220523.14 "Check Valves for Plumbing Piping," according to the following:

1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
2. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 INSTALLATION OF PIPING, GENERAL

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Where installing piping adjacent to equipment and machines, allow space for service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
1. Use steel companion flange with gasket for connection to steel pipe.

- I. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, in accordance with Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F2014.
- J. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- K. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- L. Install pressure gauge on discharge piping from each air compressor and on each receiver.
- M. Install piping to permit valve servicing.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install seismic restraints on piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

3.5 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. NPS 2 and Smaller: Use dielectric unions.

3.6 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

- A. Install flexible pipe connectors in discharge piping of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless steel-hose flexible pipe connectors in steel compressed-air piping.

3.7 INSTALLATION OF SPECIALTIES

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment.
- D. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.
- E. Install quick couplings at piping terminals for hose connections.
- F. Install hose assemblies at hose connections.
- G. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

3.8 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for hangers, supports, and anchor devices.
- C. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for aluminum piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting and coupling.

- F. Support vertical runs of steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of aluminum piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- H. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Ft. or Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
- I. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- J. Base of Vertical Piping: MSS Type 52, spring hangers.

3.9 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

3.10 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 2. Repair leaks and retest until no leaks exist.
 - 3. Inspect filters and pressure regulators for proper operation.
- C. Prepare test and inspection reports.

END OF SECTION 221513

SECTION 221519 - GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lubricated, reciprocating air compressors.
 - 2. Inlet-air filters.
 - 3. Refrigerant compressed-air dryers.

1.2 DEFINITIONS

- A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in acfm.
- B. Standard Air: Free air at 68 deg F and 1 atmosphere before compression or expansion and measured in scfm .

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Diagrams for power, signal, and control wiring.
- C. See section 013300.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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.
- B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.

2.2 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.

- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
 - 1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
 - 2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
 - 3. Control Voltage: 120-V ac or less, using integral control power transformer.
 - 4. Motor Overload Protection: Overload relay in each phase.
 - 5. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
 - 6. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.
- C. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
 - 2. Interior Finish: Corrosion-resistant coating.
 - 3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.

2.3 LUBRICATED, RECIPROCATING AIR COMPRESSORS

- A. Basis of design product, subject to compliance with the specified product on the drawings. Provide a product by one of the following manufacturers:
 - 1. Ingersoll-Rand
 - 2. Atlas-Copco
 - 3. Or approved equal.
- B. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.
 - 1. Submerged gear-type oil pump.
 - 2. Oil filter.
 - 3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
 - 4. Belt guard totally enclosing pulleys and belts.
- C. Capacities and Characteristics:
 - a. See drawings for capacities and characteristics.

2.4 INLET-AIR FILTERS

- A. Description: Combination inlet-air filter-silencer, suitable for remote installation, for each air compressor.
 - 1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
 - 2. Capacity: Match capacity of air compressor, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers.
- B. Description: Combination inlet-air filter-silencer, suitable for remote installation, for multiple air compressors.

2.5 REFRIGERANT COMPRESSED-AIR DRYERS

- A. Description: Noncycling, air-cooled, electric-motor-driven unit with steel enclosure and capability to deliver 35 deg F, 100-psig air at dew point. Include automatic ejection of condensate from airstream, step-down transformers, disconnect switches, inlet and outlet pressure gages, thermometers, automatic controls, and filters.
- B. Capacities and Characteristics:
 - 1. See drawings for capacities and characteristics.

2.6 COMPRESSED AIR STORAGE TANK

- A. Basis of design product, subject to compliance with the specified product on the drawings. Provide a product by one of the following manufacturers:
 - 1. Ingersoll-Rand
 - 2. Atlas-Copco
 - 3. Samuel
 - 4. Or approved equal.
- B. Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
 - 2. Interior Finish: Corrosion-resistant coating.
 - 3. Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.
- C. Capacities and Characteristics:
 - 1. Maximum Air Working Pressure: 200 PSI at 400°F
 - 2. Capacity: 400 Gallons
 - 3. Provide with ring stand with welded tabs for anchoring to the ground.

2.7 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."
 - 1. Enclosure: Open, dripproof.
 - 2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load does not require motor to operate in service factor range above 1.0.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Equipment Mounting:
 - 1. Install air compressors and air dryers on cast-in-place concrete equipment base(s).
 - 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"

- B. Install compressed-air equipment anchored to substrate.
- C. Arrange equipment so controls and devices are accessible for servicing.
- D. Maintain manufacturer's recommended clearances for service and maintenance.
- E. Install the following devices on compressed-air equipment:
 - 1. Thermometer, Pressure Gage, and Safety Valve: Install on each compressed-air receiver.
 - 2. Pressure Regulators: Install downstream from air compressors and dryers.
 - 3. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221513 "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to machine, allow space for service and maintenance.

3.3 IDENTIFICATION

- A. Identify general-service air compressors and components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain air compressors and air dryers.

END OF SECTION 221519

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Commercial, power-burner, gas-fired, storage, domestic-water heaters with integral storage tank.
 - 2. Domestic-water heater accessories.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
- B. Product certificates.
- C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- 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.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

- C. ASME Compliance:
 - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Gas-Fired, Domestic-Water Heaters:
 - 1) Storage Tank: Five years.
 - 2) Controls and Other Components: One year(s).

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE TANK, DOMESTIC-WATER HEATERS

- A. Commercial, Power-Burner, Gas-Fired, Storage Tank, Domestic-Water Heaters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Lochinvar
 - b. Bradford White
 - c. Smith, A.O. Corporation
 - d. Or Approved Equal
 - 2. Standard: ANSI Z21.10.3/CSA 4.3.
 - 3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
 - b. Interior Finish: Comply with NSF 61 Annex barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Glass complying with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
 - 4. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.

- c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters, and natural-gas fuel.
 - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- 5. Special Requirements: NSF 5 construction.
 - 6. The water heater specified on the drawings does not require an equipment pad to drain properly. If a substituted water heater requires a pad; contractor to provide an equipment pad as required for proper draining with bid at no additional cost to owner.

2.2 WATER HEATER ACCESSORIES

- A. Domestic-Water Expansion Tanks:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Wessels
 - c. Elbi
 - d. Or approved equal
 - 2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- D. Heat-Trap Fittings: ASHRAE 90.2.

- E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- F. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
 - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
 - C. Install gas-fired, domestic-water heaters according to NFPA 54.
 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."
 - D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 - E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
 - F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties." To be CPVC piping from water heater to neutralizer and copper from neutralizer to floor drain/sink.
 - G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
 - H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
 - I. Fill domestic-water heaters with water.
 - J. Charge domestic-water compression tanks with air.
- 3.2 CONNECTIONS
- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

- B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 223400

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Flushometer valves.
 - 3. Toilet seats.
 - 4. Supports.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

- A. Water Closets: Wall mounted, top spud, accessible.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
 - c. TOTO USA, INC.
 - 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard.
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.28 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.
 - 3. Flushometer Valve: Refer to drawings.
 - 4. Toilet Seat: Refer to drawings.
 - 5. Support: Water closet carrier, refer to drawings.
 - 6. Water-Closet Mounting Height: Refer to architectural drawings for mounting height.

2.2 FLUSHOMETER VALVES

A. Manual Diaphragm-Type Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Zurn Industries, LLC.
 - b. Sloan Valve Company.
 - c. Or Approved Equal.
2. Standard: ASSE 1037. And ASME A112.19.2M.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
9. Trip Mechanism: Trip Lever that is ADA compliant
10. Style: Exposed.
11. Sensor: Adjustable sensor eyes
12. Consumption: 1.28 gal. per flush.
13. Minimum Inlet: NPS 1.
14. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2.
 - a. American Standard America.
 - b. Bemis Manufacturing Company.
 - c. Church Seats; Bemis Manufacturing Company.
 - d. Zurn Industries, LLC.
3. Standard: IAPMO/ANSI Z124.5.
4. Material: Plastic.
5. Type: Commercial (Heavy duty).
6. Shape: Elongated rim, open front.
7. Hinge: Self-sustaining, check.
8. Hinge Material: Noncorroding metal.
9. Seat Cover: Not required.
10. Color: White.

2.4 SUPPORTS

A. Water Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Zurn Industries, LLC.
 - b. Or Approved Equal
2. Standard: ASME A112.6.1M.

3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Water-Closet Installation:
 1. Install level and plumb according to roughing-in drawings.
 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
 3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
 2. Use carrier supports with waste-fitting assembly and seal.
 3. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
- C. Flushometer-Valve Installation:
 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
 4. Install actuators in locations that are easy for people with disabilities to reach.
 5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Install toilet seats on water closets.
- E. Wall Flange and Escutcheon Installation:
 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- F. Joint Sealing:
 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 2. Match sealant color to water-closet color.
 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.2 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.3 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Adjust sensors to ensure proper sensor operation and flush valve operation.

3.4 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224213.16 - COMMERCIAL URINALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Urinals.
 - 2. Flushometer valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

- A. Urinals: Wall hung, back outlet, siphon jet, accessible.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
 - c. TOTO USA, INC.
 - 2. Fixture:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 - e. Water Consumption: Water saving.
 - f. Spud Size and Location: NPS 3/4; top.
 - g. Outlet Size and Location: NPS 2; back.
 - h. Color: White.
 - 3. Flushometer Valve: Refer to drawings.
 - 4. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
 - b. Size: NPS 2.
 - 5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.

2.2 URINAL FLUSHOMETER VALVES

- A. Manual operated, Diaphragm-Type Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sloan Valve Company.
 - b. Zurn Industries, LLC.
 - c. Or approved equal.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
9. Trip Mechanism: ADA-Compliant Trip Lever
10. Style: Exposed.
11. Sensor: Adjustable sensor eyes
12. Consumption: 0.5 gallon per flush.
13. Minimum Inlet: NPS 3/4.
14. Minimum Outlet: NPS 1-1/4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Urinal Installation:
 1. Install urinals level and plumb according to roughing-in drawings.
 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
 3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
 4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
 5. Install trap-seal liquid in waterless urinals.
- B. Support Installation:
 1. Install supports, affixed to building substrate, for wall-hung urinals.
 2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
 3. Use carriers without waste fitting for urinals with tubular waste piping.
 4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

- C. Flushometer-Valve Installation:
 - 1. Install flushometer-valve water-supply fitting on each supply to each urinal.
 - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 - 3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
 - 4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 - 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
 - 1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to urinal color.
 - 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Adjust sensors to ensure proper sensor operation and flush valve operation.

3.5 CLEANING AND PROTECTION

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lavatories.
 - 2. Faucets.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory: Vitreous china, wall mounted, with back.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Standard America.
 - b. Kohler Co.
 - c. TOTO USA, INC.
 - 2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Faucet-Hole Location: Top.
 - d. Color: White.
 - e. Mounting Material: Chair carrier.
 - 3. Faucet: Refer to drawings.
 - 4. Support: carrier with OSHPD compliant legs, concealed-arm lavatory carrier.

2.2 SOLID-BRASS, MANUAL FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Deck Mounted, single-control mixing, commercial, solid-brass valve.
 - 1. Manufacturers:
 - a. Chicago Faucets.
 - b. Sloan Valve Company
 - c. Moen Commercial.
 - d. American Standard Commercial.
 - 2. Standard: ASME A112.18.1/CSA B125.1.
 - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
 - 4. Body Type: 4" On centers.
 - 5. Body Material: Commercial, solid brass.
 - 6. Finish: Polished chrome plate.
 - 7. Maximum Flow Rate: 0.5 gpm with vandal proof aerator.
 - 8. Mounting Type: Deck exposed.
 - 9. Spout: Rigid.
 - 10. Spout Outlet: Aerator.
 - 11. Drain: Grid Drain.

2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type, or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel or Lever handle.
- F. Risers:
 - 1. NPS 3/8.
 - 2. Flexible tube riser.

- G. Fittings shall be suitable for continuous use at 120°F.

2.4 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

- C. Trap:
 - 1. Size: NPS 1-1/2 by NPS 1-1/4.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap, and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
 - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."
- G. Contractor to install new set of batteries for battery powered faucet after commissioning.

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mop service basins.
 - 2. Laundry Sink
 - 3. Handwash and breakroom sinks.
 - 4. Sink faucets.
 - 5. Supply fittings.
 - 6. Waste fittings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 MOP SERVICE BASINS

- A. Service Basins: Plastic, floor mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Florestone Products Co., Inc.
 - b. Fiat
 - c. Zurn Industries, LLC.
 - 2. Fixture:
 - a. Standard: IAPMO/ANSI Z124.6.
 - b. Material: Receptor shall be manufactured of tan and white marble chips cast in white Portland cement to produce a compressive strength of not less than 3000 PSI, seven days after casting. Terrazzo surface shall be ground and polished with all air holes and/or pits to be grouted and excess removed and sealed to resist stains and moisture. Receptor will be reinforced with 16-gauge wire.
 - c. Nominal Size: Refer to drawings schedule
 - d. Tiling Flange: Required
 - e. Rim Guard: On front top surfaces.
 - f. Color: Standard.
 - g. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.

B. Faucet:

1. Brass construction, chrome finish
2. Vacuum-breaker spout with garden hose thread
3. 1/2" IPS connections
4. Vandal resistant torx head screws
5. With service stops
6. Operation: Wrist blade handles with hot and cold color indicators
7. Flow: Unrestricted
8. Cartridge: Ceramic disc cartridge, 1/4 turn operation, Nonmetallic and nonferrous material
9. Standards: Third party certified by CSA to meet ASME A112.18.1 and all applicable specifications referenced therein for lever handles
10. Warranty: Warranted for 5 years against material or manufacturing defects.

2.2 LAUNDRY SINKS

A. Utility Sinks: Stainless steel, Floor-mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Just Manufacturing.
2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Seamless welded construction, fabricated of 14-gauge type 304 stainless steel with Integra Flow. 1-1/2" dia. roll rim.
 - c. Surfaces polished to a Hand-Blended Just Finish. Exposed exterior surfaces polished with a standard brush finish.
 - d. Four 14-gauge type 304 stainless steel legs with angle frame.
 - e. Number of Compartments: One.
 - f. Overall Dimensions: Refer to drawing schedule
 - g. Metal Thickness: Refer to drawing schedule
3. Faucet(s):
 - a. Required: One.
 - b. Mounting: Wall.
 - c. Brass construction, chrome finish
 - d. Vacuum-breaker spout with garden hose thread
 - e. Vandal resistant torx head screws
 - f. With service stops
 - g. Operation: Wrist blade handles with hot and cold color indicators
 - h. Flow: Unrestricted
 - i. Cartridge: Ceramic disc cartridge, 1/4 turn operation, Nonmetallic and nonferrous material
 - j. Standards: Third party certified by CSA to meet ASME A112.18.1 and all applicable specifications referenced therein for lever handles
 - k. Warranty: Warranted for 5 years against
 - l. See plumbing fixture schedule on drawings for specific faucet type.
4. Supply Fittings:
 - a. Standard: ASME A112.18.1/CSA B125.1.

- b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
 - 1) Operation: Wheel handle.
 - 2) Risers: NPS 1/2, ASME A112.18.6, braided or corrugated stainless-steel flexible hose.
- 5. Waste Fittings:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Trap(s):
 - 1) Size: NPS 1-1/2.
 - 2) Material: Chrome-plated, two-piece, cast-brass trap, and swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated brass or steel wall flange.
 - 3) Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.
 - c. Continuous Waste:
 - 1) Size: NPS 1-1/2.
 - 2) Material: Chrome-plated, 0.032-inch- thick brass tube.
- 6. Mounting: On counter with sealant.

2.3 HANDWASH AND BREAKROOM SINKS

- A. Handwash Sinks: Stainless steel, floor/wall mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Just Manufacturing.
 - 2. Fixture:
 - a. Standards: ASME A112.19.3/CSA B45.4 and NSF/ANSI 2.
 - b. Type: Basin with radius corners, back for faucet, and support brackets.
 - 3. Faucet(s):
 - a. Required: One.
 - b. Mounting: On ledge
 - c. Brass construction with chrome plated finish
 - d. Operation: 4" wrist blade handles with hot and cold color indicators, 1/4 turn to open (clockwise to close), Vandal resistant torx head screws
 - e. Cartridge: Brass shell, ceramic disc cartridge, Nonmetallic/nonferrous and ceramic material
 - f. Standards: Third party certified to meet A112.18.1/CSA B125.1 and all applicable specifications referenced therein
 - g. Certified to NSF 61/9
 - h. Contains no more than 0.25% weighted average lead content
 - i. See plumbing fixture schedule on drawings for specific faucet type.
 - 4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
 - 5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.
 - 6. Support: ASME A112.6.1M, Type II, sink carrier.

2.4 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type, or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel or lever handle.
- F. Risers:
 - 1. NPS 3/8
 - 2. Chrome-plated, rigid-copper pipe.
- G. Fittings shall be suitable for continuous use at 120°F.

2.5 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2.
 - 2. Material: Chrome-plated, two-piece, cast-brass trap, and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
 - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.

- E. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 224223 - COMMERCIAL SHOWERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Shower heads and shower valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Shower valves intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 SHOWER HEADS AND SHOWER VALVES

- A. Shower Head with Single-Handle, Thermostatic/Pressure-Balancing Mixing Valve:
1. Basis of design product, subject to compliance with the specified product on the drawings. Provide a product by one of the following manufacturers:
 - a. American Standard.
 - b. Sloan.
 - c. Moen Commercial.
 - d. Or approved equal.
 2. Description: Single-handle, accessible, thermostatic/pressure-balancing mixing valve with hot- and cold-water indicators; check stops; and hose with handheld shower head on sliding rod shower head.
 3. Shower Valve:
 - a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016/ASME A112.1016/CSA B125.16.
 - b. Body Material: Solid brass.
 - c. Finish: Polished chrome plate.
 - d. Mounting: Exposed.
 - e. Operation: Single-handle, twist or rotate control.
 - f. Antiscald Device: Integral with mixing valve.
 - g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

4. Supply Connections: NPS 1/2.
5. Shower Head:
 - a. Shower Head Maximum Flow Rate: 2.5 gpm.
 - b. Shower Head Material: Metallic with chrome-plated finish.
 - c. Spray Pattern: Adjustable.
 - d. Integral Volume Control: Required.
 - e. Temperature Indicator: Integral with valve.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble shower components according to manufacturers' written instructions.
- B. Install showers level and plumb.
- C. Install ball valves in water-supply piping to the shower if supply stops are specified with the shower valve. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping Install valves in locations that are accessible for ease of operation.
- D. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 PIPING CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.3 ADJUSTING

- A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.
- B. Adjust water pressure at shower valves to produce proper flow.

3.4 CLEANING AND PROTECTION

- A. After completing installation of showers, inspect and repair damaged finishes.

- B. Clean showers, shower valves, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

END OF SECTION 224223

SECTION 224233 - WASH FOUNTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-surface, semicircular wash fountains.

B. Related Requirements:

1. Section 224216.13 "Commercial Lavatories."
2. Section 224216.16 "Commercial Sinks."

1.2 ACTION SUBMITTALS

A. Product Data.

B. See specification section 01 33 00 for additional submittal requirements.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Warranty.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Wash fountain spray heads and faucets intended to convey or dispense water for human consumption must comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or must be certified in compliance with NSF 61 and NSF 372 (by an ANSI-accredited third-party certification body) that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Comply with IAPMO IGC 156 for solid-surface and stainless-steel wash fountains.

C. Comply with ASME A112.18.1/CSA B125.1 for water supply fittings.

D. Comply with ASME A112.18.2/CSA B125.2 for plumbing waste fittings.

E. Comply with ASSE 1016 for mixing valves.

2.2 SOLID-SURFACE, SEMICIRCULAR WASH FOUNTAINS

A. Wash Fountains - Floor Mounted, Solid Surface, Semicircular Receptor:

1. Basis-of-design product, subject to compliance with the specified product on the drawings. Provide a product by one of the following manufacturers:
 - a. Bradley.
 - b. Acorn.
 - c. Sloan.
 - d. Or Approved equal.
2. Receptor:
 - a. Nominal Diameter: 36 inches
 - b. Height to Rim: Standard.
 - c. Color or Finish: Provide architect with physical color samples of manufacturer's options during submittals.
 - d. Drain: Grid with NPS 2 tailpiece.
3. Spray Head:
 - a. Material: Stainless steel or integral part of receptor back.
 - b. Number of User Stations: 3.
 - c. Control: foot-control actuation with thermostatic mixing valve, and having check stops.
4. Supply Fittings:
 - a. Piping: NPS 3/4 copper tubing.
 - b. Valves: Shutoff valve on each supply.
 - c. Supply Piping: From top.
5. Waste Fittings:
 - a. Trap and Drain Piping: NPS 2.
 - b. Vent Piping: NPS 1-1/2 to ceiling.
6. Floor Mounting: Manufacturer's floor bracket and wall bracket attached to reinforcement in wall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply piping, and sanitary drainage and vent piping systems to verify actual locations of piping connections before wash-fountain installation.
- B. Examine walls and floors for suitable conditions where wash fountains will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install wash fountains level and plumb in accordance with rough-in drawings.
- B. Set freestanding wash fountains on floor.
- C. Install off-floor carrier supports, affixed to building substrate, for wall-mounted wash fountains.
- D. Install water-supply piping with shutoff valve on each supply to each wash fountain to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping."
- E. Waste piping on each drain outlet of each wash fountain to be connected to sanitary drainage system.
- F. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 - 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Joint Sealing:
 - 1. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to fixture color.
 - 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 PIPING CONNECTIONS

- A. Connect wash fountains with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with requirements for waste drainage piping and vent piping specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust wash fountains and controls. Replace damaged and malfunctioning wash fountains, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After installing wash fountains, inspect and repair damaged finishes.
- B. Clean wash fountains, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Install protective covering for installed wash fountains and fittings.
- D. Do not allow use of wash fountains for temporary facilities unless approved in writing by Owner.

END OF SECTION 224233

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Combination units.
 - 2. Water-tempering equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- 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.
- B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
- D. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities"; for plumbing fixtures for people with disabilities.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

- A. Standard, Plumbed Emergency Shower with Eyewash Combination Units:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Haws Manufacturing Corp.
 - b. Bradley Corp.
 - c. Chicago Faucets.
 - d. Approved Equal.

2. Piping:
 - a. Material: Chrome-plated brass or stainless steel.
 - b. Unit Supply: NPS 1-1/4 minimum.
 - c. Unit Drain: Outlet at back or side near bottom.
3. Shower:
 - a. Capacity: Not less than 20 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod.
 - d. Shower Head: 8-inch minimum diameter, plastic.
 - e. Mounting: Pedestal.
4. Eyewash Unit:
 - a. Capacity: Not less than 0.4 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Spray-Head Assembly: Two receptor-mounted spray heads.
 - e. Receptor: Chrome-plated brass or stainless-steel bowl.
 - f. Mounting: Attached shower pedestal.

2.2 WATER-TEMPERING EQUIPMENT

- A. Hot- and Cold-Water, Water-Tempering Equipment:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Leonard Valve Company.
 - b. Bradley Corporation.
 - c. Guardian Equipment.
 - d. Approved Equal.
 2. Description: Factory-fabricated equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide 80 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
 - b. Supply Connections: For hot and cold water.

2.3 SOURCE QUALITY CONTROL

- A. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

2.4 EMERGENCY PLUMBING FIXTURE INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.

- D. Install shutoff valves in water-supply piping to fixtures. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
 - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 221116 "Domestic Water Piping."
- F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."
- H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."
- I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
- J. Fill self-contained fixtures with flushing fluid.

2.5 CONNECTIONS

- A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping."
- B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 221116 "Domestic Water Piping."
- C. Connect cold water and electrical power to electric heating water-tempering equipment. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping."
- D. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

- E. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.
- F. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

2.6 IDENTIFICATION

- A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 220553 "Identification for Plumbing Piping and Equipment."

2.7 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry, has been energized, start units to confirm proper unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

2.8 ADJUSTING

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

END OF SECTION 224500

SECTION 224713 - DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Stainless Steel Drinking Fountains
 - 2. Bottle Fillers

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of drinking fountains.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

- A. Drinking Fountains: Stainless steel, wall mounted.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Haws Corporation.
 - b. Elkay.
 - 2. Standards:
 - a. Comply with ASME A112.19.3/CSA B45.4.
 - b. Comply with NSF 61.
 - 3. Back Panel: Stainless-steel wall plate behind drinking fountain.
 - 4. Bubblers: Single, with adjustable stream regulator, located on deck.
 - 5. Control: Manual Bar.
 - 6. Drain: Grid type with NPS 1-1/4 tailpiece.
 - 7. Supply Piping: NPS 3/4 with shutoff valve.
 - 8. Drain Piping: ASME A112.18.2/CSA B125.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
 - 9. Support: ASME A112.6.1M, Type III lavatory carrier.
- B. Bottle-Filling Station: Surface-mounted, ADA compliant
 - 1. Basis-of-Design Product: Subject to compliance with requirements with the specified product on the drawings, provide a product by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Haws.
 - c. Or approved equal
 - 2. Standards:
 - a. Comply with ASME A112.19.3/CSA B45.4.
 - b. Comply with NSF 61 and NSF 372.
 - c. Comply with ICC A117.1.
 - 3. Cabinet: Galvanized steel.
 - 4. Filtration: Carbon block filter with filter life indicator.
 - 5. Water Flow Control: Manual button.

6. Capacities:
 - a. Water Flow Rate: 0.5 gpm, laminar flow.
7. Drain: Grid type with NPS 1-1/4 tailpiece.
8. Supply: NPS 3/8.
9. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 tailpiece.
10. 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.
11. Bottle-Filling Station Mounting Height: See architectural drawings.

PART 3 - EXAMINATION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Set pedestal drinking fountains on floor.
- C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation.
- E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Adjust fixture flow regulators for proper flow and stream height.

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 CLEANING

- A. After installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224713

SECTION 226888 LUBE OIL PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes piping and related specialties for welding gas systems, as follows:
 - 1. Pipes, tubes, and fittings.
 - 2. Valves.
 - 3. Flexible pipe connectors.
 - 4. Hose Reel Assemblies
 - 5. Lube/Oil Pumps

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Pipes, fittings, and valves.
 - 2. Hose assemblies.
- B. See specification section 01 33 00.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Schedule 80, Steel Pipe: ASTM A53/A53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded in accordance with ASME B1.20.1.
 - 1. Steel Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 80, galvanized seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Fittings: ASME B16.3, Class 300, threaded.
 - 3. Malleable-Iron Unions: ASME B16.39, Class 300, threaded.
 - 4. Steel Flanges: ASME B16.5, Class 300, carbon steel, threaded.
 - 5. Wrought-Steel, Butt-Welding Fittings: ASME B16.9, Schedule 80.
 - 6. Steel Flanges: ASME B16.5, Class 300, carbon steel.
- B. Schedule 80, Stainless Steel Pipe: ASTM SA249, A269, A270 Type 316L stainless steel piping.
 - a. Wall thicknesses.
 - a. 1/2-inch O.D. tube shall have a minimum of 0.109-inch thickness
 - b. 3/4-inch O.D. tube shall have a minimum of 0.113-inch thickness
 - c. 1-inch O.D. tube shall have a minimum of 0.133-inch thickness
 - b. Flareless, Mechanical Grip Type Fittings:
 - a. Manufacturers:
 - i. Swagelok
 - ii. Ingersoll-Rand
 - iii. Or approved equal

- b. 316 Stainless high pressure threaded fittings.
 - c. Fittings shall be rated for pressures greater 5,000 psi.
- C. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 VALVES

- A. Two-Piece, Carbon-Steel Ball Valves with Standard Port and Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Milwaukee Valve.
 - b. NIBCO INC.
 - c. Red-White Valve Corporation.
 - d. Watts; a Watts Water Technologies company.
 - e. Jomar.
 - 2. Description:
 - a. Standard: ANSI B1.20.1, API 598, and MSS SP-110
 - b. Pressure Rating: 2000 WOG
 - c. Body Design: Two piece.
 - d. Body Material: Carbon Steel.
 - e. Ends: Threaded.
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel.
 - i. Port: Standard
- B. 316 Stainless Steel Ball Valves with Standard Port and Stainless-Steel Trim:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Swagelok
 - b. Ingersoll Rand
 - c. Milwaukee Valve.
 - d. NIBCO INC.
 - e. Red-White Valve Corporation.
 - f. Watts; a Watts Water Technologies company.
 - g. Jomar.
 - 2. Description:
 - a. Standard: ANSI B1.20.1, API 598, and MSS SP-110
 - b. Pressure Rating: 3000 WOG
 - c. Body Design: Five-piece.
 - d. Body Material: Stainless steel
 - e. Ends: Swagelok or threaded
 - f. Seats: PTFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel.
 - i. Port: Standard

2.3 FLEXIBLE PIPE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Parker
 - b. Swagelok
 - c. Or approved equal
- C. Lube flexible piping to be Parker 2244N (or approved equal)
 - 1. Polyamide inner
 - 2. Two spiral layers, one braided layer of high tensile steel wire
 - 3. Polyurethane Cover
 - 4. Maximum working pressure of 10,000 psi
- D. Oil Flexible Piping
 - 1. EPDM inner hose with ARPM Class C Tubing and EPDM cover.
 - 2. Working-Pressure Rating: 600 psig minimum.
 - 3. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.

2.4 HOSE REEL ASSEMBLIES

- A. Description: Retractable hose reels with hoses.
 - 1. Manufacturer: Basis-of-Design Product, subject to compliance with the specified product on the drawings, provide a product by one of the following manufacturers:
 - a. Graco
 - b. Reelcraft
 - c. Or Approved Equal
 - 2. Hose: EPDM interior, with reinforcement and EPDM cover
 - a. Rating: Hoses shall be rated up to 1,000 PSI
 - 3. Hose Reel: carbon steel hose reel, shall be retractable type with mounting frame to structure.

2.5 LUBE/OIL PUMPS

- A. Description: Drum-mounted lube/oil pumps operated by compressed air.
 - 1. Manufacturer: Basis-of-Design Product, subject to compliance with the specified product on the drawings, provide a product by one of the following manufacturers:
 - a. Graco
 - b. Lincoln
 - c. Or Approved Equal
 - 2. Self-priming type pump with Buna-N seal.
 - 3. Rated for an outlet pressure of up to 1,000 psi with a maximum air inlet pressure of 200 PSI
 - 4. Manufacturer's quick coupler connection for compressed air and lube oil.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS

- A. Lube/Oil Piping from Pump to Hose Reel: Use the following piping materials for each size range:

1. NPS 2 and Smaller: Schedule 40, black-steel pipe; threaded, malleable-iron fittings; and threaded joints.

3.2 INSTALLATION OF PIPING, GENERAL

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Where installing piping adjacent to equipment and machines, allow space for service and maintenance.
- F. Install lube/oil piping with a 1% slope back to tanks.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
- I. Use steel companion flange with gasket for connection to steel pipe.
- J. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- K. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- L. Install pressure gauge on discharge piping from each air compressor and on each receiver.
- M. Install piping to permit valve servicing.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install seismic restraints on piping. Seismic-restraint devices are specified in Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping.
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping.
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 - Escutcheons for Plumbing Piping.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Flareless, mechanical grip-type joints shall be installed per manufacturer's instructions.

3.4 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

- A. Install flexible pipe connectors in discharge piping of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless steel-hose flexible pipe connectors in steel compressed-air piping.

3.5 INSTALLATION OF SPECIALTIES

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment.
- D. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.
- E. Install quick couplings at piping terminals for hose connections.
- F. Install hose assemblies at hose connections.

- G. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for hangers, supports, and anchor devices.
- C. Install hangers for steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for aluminum piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping within 12 inches of each fitting and coupling.
- F. Support vertical runs of steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of aluminum piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- H. Individual, Straight, Horizontal Piping Runs:
 - I. 100 Ft. or Less: MSS Type 1, adjustable, steel clevis hangers.
 - J. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
 - K. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - L. Base of Vertical Piping: MSS Type 52, spring hangers.

3.7 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

3.8 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air

or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

2. Repair leaks and retest until no leaks exist.
3. Inspect filters and pressure regulators for proper operation.

C. Prepare test and inspection reports.

3.9 PIPING SCHEDULE

A. Oil Piping

1. Schedule 80 Steel Piping with threaded fittings.

B. Lube Piping

1. Schedule 80, 316L Stainless Steel Piping with flareless mechanical grip fittings.

END OF SECTION 226888

SECTION 230000-COMMON WORK RESULTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
 2. Mechanical demolition.
 3. Equipment installation requirements common to equipment sections.
- B. The information indicated on the drawings as existing is based upon information taken from as-built drawings, field investigation, and information obtained from submittal data, etc. The plans do not guarantee accuracy but are only an indication of existing conditions. It is the contractor's responsibility to field verify exact conditions such as equipment placement, ductwork (size, routing, and elevation), piping (size, routing, and elevation), etc. The drawings are intended to provide the contractor an indication of the system installed in the facility to date. It will be the contractor's responsibility to make adjustments to the drawing information as required to match existing field conditions.
- C. The contractor shall install the new equipment, ductwork, and piping around all existing obstacles including: electrical conduit, domestic water piping, waste and vent piping, chilled and heating water piping, and fire sprinkler piping. Provide offsets to avoid relocation of other utilities. Relocate utilities if they are in conflict with the mechanical system installation, cause deviations in the design intent, unsatisfactory operation, noisy conditions, or interfere with maintenance. It is the mechanical contractor's responsibility to coordinate any utility relocation with the appropriate subcontractor.
- D. Provide all necessary labor, materials, equipment, services, and insurances to complete the heating, ventilating and air conditioning work within the full intent of the drawings and specifications contained hereon and to the entire satisfaction of the engineer.
- E. All dimensions and measurements shall be verified at the jobsite before fabrication and/or installation of the equipment.
- F. Contractor shall visit the site and become familiar with the project before bidding.

1.2 DEFINITIONS

- A. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- B. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

1.3 SUBMITTALS

- A. See specification section 001330, "Submittal Procedures".

B. Welding certificates.

1.4 WORKMANSHIP

A. All work to be performed by qualified personnel normally engaged in the respective line of work.

B. Perform all work in a manner not to disturb the normal operation of the building.

C. Coordinate all work with the owner's representative.

D. The mechanical contractor is responsible for performing all work acceptable to the owner's representative.

1.5 PROJECT/SITE CONDITIONS

A. Examine the site, verify dimensions and locations against the 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 locations is based upon available records and data but shall be regarded as approximate only. Make minor deviations found necessary to conform with actual locations and conditions without extra cost.

C. Install work in locations shown on drawings, unless prevented by project conditions.

D. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other sections. Obtain permission of Owner/Engineer before proceeding.

1.6 QUALITY ASSURANCE

A. Steel Pipe Welding: Qualify processes and operators shall be in accordance with the following:

1. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

C. Reference Building Codes and Standards:

1. IBC – 2018 International Building Code
2. UMC – 2018 Uniform Mechanical Code
3. UPC – 2018 Uniform Plumbing Code
4. IFC – 2018 International Fire Code
5. IECC – 2018 International Energy Conservation Code
6. NFPA – National Fire Protection Association
7. NEC – National Electrical Code

8. Nevada State Regulatory Agencies
9. ANSI – American National Standards Institute
10. SMACNA – Sheet Metal and Air Conditioning Contractors National Association
11. ASME – American Society of Mechanical Engineers
12. UL – Underwriters Laboratory
13. ASHRAE Handbooks
14. ASHRAE Standards
15. SMACNA Duct Construction Standards
16. ASPE Data Books
17. ASMI CSD-1, latest adopted edition by the State of Nevada.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. coordinate with the owner prior to the beginning of demolition work of equipment and material that the owner will salvage.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PRODUCT HANDLING

- A. Protection: use all means necessary to protect the materials of this section before, during, and after installation and to protect the materials and work of the other trades.
- B. Replacements: in the event of damage, immediately make all repairs and replacements necessary to the approval of the engineer and at no additional cost to the owner.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.4 CARE AND CLEANING

- A. Replace broken, damaged, or otherwise defective parts, materials, and work. Leave the entire work in a condition satisfactory to the architect and owner. At completion, carefully clean and adjust equipment, fixtures, and trim which are installed as part of this work. Leave systems and equipment in satisfactory operating condition.
- B. Drain and flush piping to remove grease and foreign matter.
- C. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.

END OF SECTION 230000

SECTION 230189-HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following HVAC water-treatment systems:
 - 1. Bypass chemical-feed equipment
 - 2. Chemical treatment test equipment.
 - 3. HVAC water-treatment chemicals.

1.2 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including hot-water heating, shall have the following water qualities:
 - 1. pH: Maintain a value within 9.0 to 10.5.
 - 2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 - 3. Boron: Maintain a value within 100 to 200 ppm.
 - 4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 - 5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - 6. TDS: Maintain a maximum value of 10 ppm.
 - 7. Ammonia: Maintain a maximum value of 20 ppm.
 - 8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
 - 9. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
 - c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
- C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. San Joaquin Chemicals Telephone No. (800) 647-9577
 - 2. Chemtex Corporation Telephone No. (775) 846-8045
 - 3. Garratt Callahan Telephone No. (972) 661-5006

2.2 CHEMICALS

- A. Add a non-chromate corrosion inhibitor (Sanacor 2301, or approved equal) to the recommended level of concentration (600 to 900 ppm sodium nitrite). Furnish the Owner with an inhibitor test kit, Taylor nitrite test set No. 1510, or approved equal.
- B. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install water testing equipment on wall near water chemical application equipment.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

- C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Division 23 Section "Common Work Results for HVAC."
- D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Division 23 Section "General-Duty Valves for HVAC Piping."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
 - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
 - 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
 - 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
 - 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 - 7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
 - 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Comply with ASTM D 3370 and with the following standards:
 - 1. Silica: ASTM D 859.
 - 2. Acidity and Alkalinity: ASTM D 1067.
 - 3. Iron: ASTM D 1068.
 - 4. Water Hardness: ASTM D 1126.
- E. System Flushing:
 - 1. Install a 20 mesh screen on all strainers during system flushing.
 - 2. Replace strainer screens with specified after system flushing has been completed.

END OF SECTION 230189

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small, and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 4,500 above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.

- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
 - 2. Energy and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Electronically commuted motors (ECM), shall be permanently lubricated with heavy-duty ball bearings to match load.
- B. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor.
- C. Motor shall be speed controlled down to 20% full speed.
- D. Motor speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal.
- E. Motor shall be a minimum of 85% efficient at all speeds.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

1.1 SUMMARY

- A. Section Includes:
 - 1. Packless expansion joints.
 - 2. Alignment guides and anchors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Warranty Information.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.2 PACKLESS EXPANSION JOINTS

- A. Flexible-Hose Packless Expansion Joints:
 - 1. Basis-of-Design Product, subject to compliance with the specified product on the drawings, provide a product by one of the following manufacturers:
 - a. Twin City Hose.
 - b. Engineered Hose.
 - c. Flex-Hose.
 - d. Unisource.
 - e. Or Approved Equal.
 - 2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, V-shaped bend, or center section of flexible hose.
 - 3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.

4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
 - a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
 - b. Hoses on domestic hot water, cold water, and hot water return shall be NSF-61, Lead-Free compliant.
5. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon steel fittings with threaded end connections.
 - a. Stainless steel hoses and single-braid, stainless steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
 - b. Joints used for natural gas shall be UL-listed for natural gas use.
6. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon steel fittings with flanged end connections.
 - a. Stainless steel hoses and single-braid, stainless steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.

2.3 ALIGNMENT GUIDES AND ANCHORS

- A. Alignment Guides:
 1. Guides shall be manufactured by the flexible hose manufacturer.
 2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe.
- B. Anchor Materials:
 1. Steel Shapes and Plates: ASTM A36/A36M.
 2. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
 3. Washers: ASTM F844, steel, plain, flat washers.
 4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - a. Stud: Threaded, Stainless steel.
 - b. Expansion Plug: Stainless steel.
 - c. Washer and Nut: Stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXPANSION JOINTS - GENERAL

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.

3.2 INSTALLATION OF ALIGNMENT GUIDES AND ANCHORS

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install one guide on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe, and secure guides to building structure.

- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:
 - 1. See structural drawings for anchor attachment specifications.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
 - 1. See structural drawings for anchor attachment specifications.

3.3 INSTALLATION OF PIPE LOOP AND SWING CONNECTIONS

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.

END OF SECTION 230516

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements
- B. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron wall pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-steel wall pipes: ASTM A53/A53M, Schedule 40, with plain ends and welded steel collar: zinc coated.
- C. Galvanized Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- E. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Pipeline Seal and Insulator, Inc.
 - c. Or approved equal.
- B. Descriptions: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - a. Sealing Elements: EPDM – rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - b. Pressure Plates: Stainless steel.
 - c. Connecting bolts and nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space

between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6 Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6 Steel pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
 - 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6 Steel pipe sleeves.

END OF SECTION 230517

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated, and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

- f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
- i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
- j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
- k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

- 1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bimetallic-actuated thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Miljoco Corporation.
 - 2. Trerice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. Weksler Glass Thermometer Corp.
- B. Standard: ASME B40.200.
- C. Case: Sealed type(s); cast aluminum or drawn steel; 5-inch nominal diameter
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle and rigid, bottom, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus, or minus 1 percent of scale range.

2.2 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - 3. Material for Use with Copper Tubing: CNR or CUNI.
 - 4. Material for Use with Steel Piping: CRES.
 - 5. Type: Stepped shank unless straight or tapered shank is indicated.
 - 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
 - 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
 - 8. Bore: Diameter required to match thermometer bulb or stem.
 - 9. Insertion Length: Length required to match thermometer bulb or stem.
 - 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Miljoco Corporation.
 - b. Terice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - d. Weksler Glass Thermometer Corp.
 - 2. Standard: ASME B40.100.
 - 3. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
 - 8. Pointer: Dark-colored metal.
 - 9. Window: Glass.
 - 10. Ring: Metal.
 - 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
- H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- I. Install remote-mounted pressure gages on panel.
- J. Install valve and snubber in piping for each pressure gage for fluids (except steam).
- K. Install valve and syphon fitting in piping for each pressure gage for steam.
- L. Install flow indicators in piping systems in accessible positions for easy viewing.
- M. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
- N. Install flowmeter elements in accessible positions in piping systems.

- O. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
- P. Install permanent indicators on walls or brackets in accessible and readable positions.
- Q. Install connection fittings in accessible locations for attachment to portable indicators.
- R. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.
- S. Install thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic zone.
 - 2. Inlet and outlet of each hydronic boiler.
 - 3. Two inlets and two outlets of each chiller.
 - 4. Inlet and outlet of each hydronic coil in air-handling units.
 - 5. Two inlets and two outlets of each hydronic heat exchanger.
 - 6. Inlet and outlet of each thermal-storage tank.
- T. Install pressure gages in the following locations:
 - 1. Discharge of each pressure-reducing valve.
 - 2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
 - 3. Suction and discharge of each pump.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- B. Connect flowmeter-system elements to meters.
- C. Connect flowmeter transmitters to meters.

3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone and building entrance shall be the following:
 - 1. Sealed, bimetallic-actuated type.
- B. Thermometers at inlet and outlet of each hydronic boiler shall be the following:
 - 1. Sealed, bimetallic-actuated type.
- C. Thermometers at inlets and outlets of each chiller shall be the following:
 - 1. Sealed, bimetallic-actuated type.

- D. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:
 - 1. Sealed, bimetallic-actuated type.
- E. Thermometers at inlets and outlets of each hydronic heat exchanger shall be the following:
 - 1. Sealed, bimetallic-actuated type.
- F. Thermometers at inlet and outlet of each hydronic heat-recovery unit shall be the following:
 - 1. Sealed, bimetallic-actuated type.
- G. Thermometers at inlet and outlet of each thermal-storage tank shall be the following:
 - 1. Sealed, bimetallic-actuated type.
- H. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 150 deg F.
- B. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.
- C. Scale Range for Heat Exchanger Loop Piping: 0 to 250 deg.F

3.6 PRESSURE-GAGE SCHEDULE.

- A. Pressure gages at discharge of each pressure-reducing valve shall be the following:
 - 1. Sealed, direct-mounted, metal case.
- B. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be the following:
 - 1. Sealed, direct-mounted, metal case.
- C. Pressure gages at suction and discharge of each pump shall be the following:
 - 1. Sealed, direct-mounted, metal case.

3.7 RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 160 psi.
- B. Scale Range for Heating, Hot-Water Piping: 0 to 160 psi.
- C. Scale Range for Heat Exchange Loop: 0 to 160 psi.

END OF SECTION 230519

SECTION 230523.12 - BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
 - 2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 3. ASME B16.18 for solder-joint connections.
 - 4. ASME B31.1 for power piping valves.
 - 5. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Refer to HVAC valve schedule articles for applications of valves.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
 - 1. Handlever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
 - 1. Include 2-inch stem extensions.
 - 2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
 - 3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

- A. Two-Piece Bronze Ball Valves with Full Port and Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. NIBCO INC.
 - d. Red-White Valve Corporation.
 - e. Watts; a Watts Water Technologies company.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.
 - k. Dezincification resistant.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- B. Select valves with the following end connections:
 1. For Copper Tubing, NPS 2-1/2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 2. For Steel Piping, NPS 2-1/2 and Smaller: Threaded ends.

3.3 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2-1/2 and Smaller: Two-piece, full port, brass, or bronze with stainless-steel trim.
 1. Valves may be provided with solder-joint ends instead of threaded ends.

END OF SECTION 230523.12

SECTION 230523.13 - BUTTERFLY VALVES FOR HVAC PIPING

1.1 SUMMARY

- A. Section Includes:
 - 1. High-performance butterfly valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. ASME Compliance:
 - 1. ASME B16.1 for flanges on iron valves.
 - 2. ASME B16.5 for flanges on steel valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B31.9 for building services valves.
- B. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Hand Lever: For valves NPS 6 and smaller.
- E. Valves in Insulated Piping: Provide with 2-inch extended neck stems.

2.2 HIGH-PERFORMANCE BUTTERFLY VALVES

- A. Single-Flange (Lug-Type), High-Performance Butterfly Valves, Class 150:
 - 1. Subject to compliance with the specifications, provide a product by one of the following manufacturers:
 - a. Nibco
 - b. Red-White Valve Corp.
 - c. Milwaukee Valve
 - d. Or approved equal
 - 2. Standard: MSS SP-68.
 - 3. CWP Rating: 285 psig at 100 deg F
 - 4. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - 5. Body Material: **Carbon** steel.
 - 6. Seat: Reinforced PTFE or metal.
 - 7. Stem: Stainless steel; offset from seat plane.
 - 8. Disc: Type 316 stainless steel.
 - 9. Service: Bidirectional.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine mating flange faces for damage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- D. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

- A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.
- B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
- C. Locate valves for easy access.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full valve actuation movement.
- F. Valve Tags: Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.
- G. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. If leakage cannot be repaired, replace valve.

3.3 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2-1/2 and Larger:
 - 1. High-Performance Butterfly Valves: Single flange, carbon-steel body, and Class 150].

END OF SECTION 230523.13

SECTION 230523.14 - CHECK VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze check valves.
 - 2. Iron check valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B1.20.1 for threads for threaded-end valves.
 - 2. ASME B16.1 for flanges on iron valves.
 - 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 4. ASME B16.18 for solder joint.
 - 5. ASME B31.1 for power piping valves.
 - 6. ASME B31.9 for building services piping valves.
- C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream piping unless otherwise indicated.
- F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE SILENT CHECK VALVES

- A. Bronze, inline, center guided silent check valve (1/4" through 2-1/2"):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Titan Flow Control
 - b. Crane; Crane Energy Flow Solutions.
 - c. Hammond Valve.
 - d. NIBCO INC.
 - e. Red-White Valve Corporation.
 - f. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. WOG (non-shock): 400 psig 100 deg. F.
 - b. Body Design: Inline flow.
 - c. Body Material: Brass CW 617N.

- d. Ends: Threaded.
- e. Check Module: Polyetherimide
- f. Seat: Buna-N
- g. Spring: Series 300 Stainless Steel

2.3 IRON CHECK VALVES

- A. Ductile Iron, globe type, center guided, silent check valve (3" through 8"):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Titan Flow Control
 - b. Crane; Crane Energy Flow Solutions.
 - c. Hammond Valve.
 - d. NIBCO INC.
 - e. Red-White Valve Corporation.
 - f. Watts; a Watts Water Technologies company.
 - 2. Description:
 - a. WOG (non-shock): 250 psig 100 deg. F.
 - b. Body Design: Inline flow.
 - c. Body Material: Ductile Iron ASTM A536
 - d. Ends: ANSI Class 150 flanged ends, flat face.
 - e. Disc: Aluminum Bronze ASTM B148
 - f. Seat: Aluminum Bronze ASTM B148
 - g. Spring: Series 300 Stainless Steel

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install swing check valves for proper direction of flow in horizontal position with hinge pin level.

3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Pump-Discharge Check Valves:
 - a. NPS 2-1/2 and Smaller: Bronze silent check valves with bronze disc.
 - b. NPS 3 and Larger: Iron check silent check valves with spring; metal-seat check valves.

- B. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 3: Flanged ends except where threaded valve-end option is indicated in valve schedules.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules.
 - 5. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.4 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2-1/2 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Bronze Check Valves: Class 150, nonmetallic disc.
- B. Pipe NPS 3 and Larger:
 - 1. Iron Check Valves: Class 125, metal seats.

END OF SECTION 230523.14

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Metal pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Thermal-hanger shield inserts.
 4. Fastener systems.
 5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes 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 and obtain approval from authorities having jurisdiction.

1.3 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. Product Data: For each type of product indicated.
- C. 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 components:
1. Trapeze pipe hangers.
 2. Equipment supports.
- D. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified State of Nevada Professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

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.

PART 2 - PRODUCTS

2.1 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: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
 - 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, 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.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552 or Type II cellular glass with 100-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 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.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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-69 and MSS SP-89. 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 A 36/A 36M, 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. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 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. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 5. Pipes NPS 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.

3.2 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.

3.3 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 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 inch.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099000 – "Painting and Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 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 and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. For black steel piping, provide and install 2-layers of 10 mil, PVC tape around piping at all supports.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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 noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

- K. 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 NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. 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 deg F piping installations.
- M. 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-joint 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. 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 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- N. 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.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. 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.

- P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Seismic bracing for mechanical systems (equipment, ductwork, piping, and conduit) shall comply with all applicable requirements of the 2018 International Building Code (IBC) including all applicable provisions 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. Compliance with the applicable seismic bracing requirements shall be accomplished utilizing the most current version of one of the following design manuals (no exceptions):
 - 1. International Seismic Application Technology (ISAT) Design Manual
 - 2. Mason Industries Seismic Restraint Design Manual
 - 3. Kinetics Noise Control Seismic Design Manual
 - 4. Vibro-Acoustics Seismic Design Manual
- C. A complete bound copy of the applicable design manual shall be provided to the Owner at the beginning of the construction period for use/reference during the course of the project.
- D. Component Importance Factors (I_p) for all mechanical equipment, ductwork, piping, and conduit shall be determined and assigned in accordance with ASCE Standard 7-16 Section 13.1.3.

1.2 SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. The Contractor shall provide the required number of seismic shop drawing submittal sets for review and approval by the Owner. Submittals shall include a comprehensive set of shop drawings clearly depicting the seismic bracing requirements for all mechanical equipment, ductwork, piping, and conduit. Any equipment that does not require seismic bracing shall be specifically identified in the submittal, and the reason for exemption shall be provided.
- C. 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 licensed in the State of Nevada.
- D. Seismic shop drawing submittals will be reviewed by both the mechanical engineer and the structural engineer.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. 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. A minimum of three site visits shall be provided, with the first visit scheduled just prior to installation of the first seismic braces, the second visit at the approximate midpoint of construction, and the third visit when the seismic bracing installation is complete (and prior to installation of ceilings).
- D. A written report shall be issued within one week of each site visit summarizing the observations made during the site visit and listing all required corrective actions and/or deficiencies.
- E. Site visits shall be coordinated with the Owner and shall be scheduled in writing a minimum of two weeks prior to the proposed site visit date.
- F. 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.

1.5 SPECIAL INSPECTION

- A. Special inspections will be arranged and paid for by the Owner when and if required by 2018 IBC Section 1704. When special inspection is required for a particular system or item of equipment the Contractor shall be available on site during each special inspection to facilitate the on-site review process.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 140 mph.
 - 2. Building Classification Category: III.

3. Minimum 10 lb./sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Risk as Defined in the IBC: III.
 - a. Component Importance Factor: 1.0.
 - b. Component Response Modification Factor: 6.0 for air-side units and ducts of sheet metal; wet-side components: 2.5.
 - c. Component Amplification Factor: 2.5 for air-side components and 1.0 for wet-side components.
3. Design Spectral Response Acceleration Parameter at Short Periods (0.2 Second): 1.610g.
4. Design Spectral Response Acceleration Parameter at 1-Second Period: 0.565g.

2.2 SEISMIC RESTRAINTS

- A.** Compliance with the applicable seismic bracing requirements shall be accomplished utilizing the most current version of one of the following design manuals (no exceptions):
1. International Seismic Application Technology (ISAT) Design Manual
 2. Mason Industries Seismic Restraint Design Manual
 3. Kinetics Noise Control Seismic Design Manual
 4. Vibro-Acoustics Seismic Design Manual

PART 3 - EXECUTION

3.1 APPLICATIONS

- A.** Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B.** Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C.** Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A.** Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- B.** Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- C.** Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
 4. All equipment shall be anchored to concrete bases.
- D. Piping Restraints:
1. Comply with requirements in MSS SP-127.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 3. Brace a change of direction longer than 12 feet.
- E. Install cables so they do not bend across edges of adjacent equipment or building structure.
- F. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
- G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- J. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test to 90 percent of rated proof load of device.
 - 5. Measure isolator restraint clearance.
 - 6. Measure isolator deflection.
 - 7. Verify snubber minimum clearances.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION 230548

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
 2. Warning signs and labels.
 3. Pipe labels.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment (Outdoor Equipment Only):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 2. Material and Thickness: anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 3. Letter Color: White.
 4. Background Color: Black.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 7. Fasteners: Stainless-steel rivets.
 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment (Indoor equipment only):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. LEM Products Inc.
 - d. Marking Services, Inc.
 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick and having predrilled holes for attachment hardware.
 3. Letter Color: White.

4. Background Color: Black.
 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F
 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 8. Fasteners: Stainless-steel rivets.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brimar Industries, Inc.
 2. Craftmark Pipe Markers.
 3. LEM Products Inc.
 4. Marking Services, Inc.
- B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
- C. Letter Color: White.
- D. Background Color: Red.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
- G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- H. Fasteners: Stainless-steel rivets.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brimar Industries, Inc.
 - 2. Craftmark Pipe Markers.
 - 3. LEM Products Inc.
 - 4. Marking Services Inc.
- B. Material and Thickness: 2-inch diameter, 20-gauge thick brass, and having predrilled hole.
- C. Top row shall indicate system connected to
- D. Bottom row shall be a unique number
- E. Provide owner with a schedule of valve numbers and locations of valves.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surface of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 EQUIPMENT LABEL SCHEDULE:

- 1. Outdoor equipment: Metal Tags
- 2. Indoor Equipment: Plastic Tags

3.5 PIPE LABEL SCHEDULE:

- 1. Heating hot water: Red background with White Letters. Provide with flow arrows.
- 2. Refrigerant piping: Blue background with White letters.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-Air volume air systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
 - 3. Domestic water system
- B. Test & Balance to be conducted by Raglen System Balance or a member of the associated air balance council.
 - 1. TAB listed office on AABC website shall be within 60 miles of job site.
- C. Test & Balance of plumbing systems such as circulation pumps, balance valves, and tempering stations are to be included. The Test & Balance contractor shall review the plumbing drawings to determine systems that fall under the procedures identified in this section.

1.2 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. TAB: Testing, adjusting, and balancing.
- C. TAB Specialist: An independent entity, meeting qualifications to perform TAB work.
- D. TDH: Total dynamic head.

1.3 INFORMATIONAL SUBMITTALS

- A. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

1.4 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine heat pumps and verify that they are accessible and their controls are

connected and functioning.

- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Duct systems are complete with terminals installed.
 - b. Volume, smoke, and fire dampers are open and functional.
 - c. Clean filters are installed.
 - d. Fans are operating, free of vibration, and rotating in correct direction.
 - e. Variable-frequency controllers' startup is complete and safeties are verified.
 - f. Automatic temperature-control systems are operational.
 - g. Ceilings are installed.
 - h. Windows and doors are installed.
 - i. Suitable access to balancing devices and equipment is provided.
 - 2. Hydronics:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.
 - c. Water treatment is complete.
 - d. Systems are flushed, filled, and air purged.
 - e. Strainers are pulled and cleaned.
 - f. Control valves are functioning per the sequence of operation.
 - g. Shutoff and balance valves have been verified to be 100 percent open.
 - h. Pumps are started and proper rotation is verified.
 - i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
 - j. Variable-frequency controllers' startup is complete and safeties are verified.
 - k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 4. Obtain approval from commissioning authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets and outlets airflow.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Adjust the variable-air-volume systems as follows:
 - 1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.

2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
 - a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
 - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
 - c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
 - f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
 - g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Balance the return-air ducts and inlets the same as described for constant-

- volume air systems.
- b. Verify that terminal units are meeting design airflow under system maximum flow.
- 8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
- 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
 - b. Re-measure and confirm that total airflow is within design.
 - c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
 - d. Mark final settings.
 - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
 - f. Verify tracking between supply and return fans.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 - 1. Check liquid level in expansion tank.
 - 2. Check highest vent for adequate pressure.
 - 3. Check flow-control valves for proper position.
 - 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
 - 5. Verify that motor starters are equipped with properly sized thermal protection.
 - 6. Check that air has been purged from the system.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Adjust pumps to deliver total design gpm.
 - 1. Measure total water flow.
 - a. Position valves for full flow through coils.
 - b. Measure flow by main flow meter, if installed.
 - c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - 2. Measure pump TDH as follows:
 - a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - c. Convert pressure to head and correct for differences in gage heights.
 - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and

- verify that the pump has the intended impeller size.
 - e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - 3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
- B. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - 1. Measure flow in main and branch pipes.
 - 2. Adjust main and branch balance valves for design flow.
 - 3. Re-measure each main and branch after all have been adjusted.
- C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - 1. Measure flow at terminals.
 - 2. Adjust each terminal to design flow.
 - 3. Re-measure each terminal after it is adjusted.
 - 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - 5. Perform temperature tests after flows have been balanced.
- D. For systems with pressure-independent valves at terminals:
 - 1. Measure differential pressure and verify that it is within manufacturer's specified range.
 - 2. Perform temperature tests after flows have been verified.
- E. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - 1. Measure and balance coils by either coil pressure drop or temperature method.
 - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- F. Verify final system conditions as follows:
 - 1. Re-measure and confirm that total water flow is within design.
 - 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - 3. Mark final settings.
- G. Verify that memory stops have been set.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
 - 1. Verify that the differential-pressure sensor is located as indicated.
 - 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
 - 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.

- 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
2. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
5. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
6. Prior to verifying final system conditions, determine the system differential-pressure set point.
7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
8. Mark final settings and verify that all memory stops have been set.
9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.

- c. Mark final settings.
 10. Verify that memory stops have been set.
- D. For systems with diversity:
 1. Determine diversity factor.
 2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.
 3. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 4. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
 5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
 6. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure, and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 7. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were

- just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
 10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 11. Mark final settings and verify that memory stops have been set.
 12. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 13. Verify that memory stops have been set.

3.10 PROCEDURES FOR DOMESTIC PLUMBING SYSTEMS

- A. Verify flow control valves matches drawings.
- B. Verify pump flows matches drawing and that pump installed in the right direction
- C. Verify backflow preventer pressure drop matches design
- D. Verify outlet temperature of tempering valves matches design
- E. Verify equal draw at water heater flow control valves.

3.11 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.12 PROCEDURES FOR BOILERS

- A. Hydronic Boilers: Measure and record entering- and leaving-water temperatures and water flow.

3.13 PROCEDURES FOR AIR HANDLERS

- A. Measure, adjust, and record the following data for each water coil:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
 - 7. Air pressure drop.
- B. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.
 - 5. Refrigerant suction pressure and temperature.

3.14 PROCEDURES FOR MAKEUP AIR UNIT

- A. Measure, adjust, and record the following data:
 - 1. Entering- and leaving-water temperature.
 - 2. Water flow rate.
 - 3. Water pressure drop.
 - 4. Dry-bulb temperature of entering and leaving air.
 - 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 - 6. Airflow.
 - 7. Air pressure drop.
 - 8. External Static Pressure.
 - 9. Evaporative Cooler is adjusted per manufacturer's instructions.

3.15 PROCEDURES FOR EXHAUST FANS

- A. Measure, adjust, and record the following data:
 - 1. Airflow.
 - 2. Static Pressure.
 - 3. Rotation of fan.

3.16 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus, or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus, or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus, or minus 10 percent.
 - 4. Heat Pump - Water Flow Rate: Plus, or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.17 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.

- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - 1. Quantities of outdoor, supply, return, and exhaust airflows.
 - 2. Water and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.

- E. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.

- F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft.
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.

- G. Air-Terminal-Device Reports:
1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft.
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- H. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
 - a. System and air-handling-unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- I. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.
 - e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.

- m. Voltage at each connection.
- n. Amperage for each phase.
- o. Full-load amperage and service factor.
- p. Seal type.
- 2. Test Data (Indicated and Actual Values):
 - a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.

J. Instrument Calibration Reports:

- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.18 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager and commissioning authority.
- B. Commissioning authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

F. Prepare test and inspection reports.

END OF SECTION 230593

SECTION 230713 DUCT INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply, return, and outdoor air.
 - 2. Outdoor, supply air

1.2 RELATED SECTIONS:

- A. Section 230719 - HVAC Piping Insulation.
- B. Section 233113 - Metal Ducts for duct liners.

1.3 ACTION SUBMITTALS

- A. See Section 013300 for submittal requirements.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties, and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Fiberglass Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Fiberglass Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall 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."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Childers Brand; H. B. Fuller Construction Products.
- b. Eagle Bridges - Marathon Industries.
- c. Foster Brand; H. B. Fuller Construction Products.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall 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."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
 2. Water-Vapor Permeance: ASTM F1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H. B. Fuller Construction Products.
 - b. Eagle Bridges - Marathon Industries.
 - c. Foster Brand; H. B. Fuller Construction Products.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 5. Color: Aluminum.
 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealants shall 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."

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.6 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Compac Corporation.
 - b. Knauf Insulation.
 - c. Venture Tape.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 SECUREMENTS

- A. Aluminum Bands: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020-inch-thick, 1/2-inch-wide with wing seal or closed seal.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems; Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
- B. Insulation Pins and Hangers:
1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Midwest Fasteners, Inc.
 - 4) Baseplate: Perforated, galvanized carbon-steel sheet, 0.030-inch-thick by 2 inches square.
 - 5) Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - 6) Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) AGM Industries, Inc.
 - 2) Gemco.
 - 3) Hardcast, Inc.
 - 4) Midwest Fasteners, Inc.
 - 5) Nelson Stud Welding.
 - 6) Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel, or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
 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. C & F Wire.

2.8 FIELD-APPLIED JACKETS

- A. Aluminum embossed jacket, 0.016" thick
 1. Adhesive: As recommended by jacket material manufacturer.
- B. Galvanized Steel jacket matching the construction of the ductwork in which it is insulating.

PART 3 EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - 1. Comply with requirements in Section 078400 - Firestopping for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 - Firestopping.

3.4 INSTALLATION OF FIBERGLASS INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.6 FINISHES

- A. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Indoor, concealed supply and outdoor air.
 2. Indoor, concealed return located.
 3. Indoor, exposed return located in unconditioned space.
- B. Items Not Insulated:
 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 2. Exposed ducts located within the room they are serving, unless noted to be insulated.
 3. Factory-insulated flexible ducts.
 4. Factory-insulated plenums and casings.
 5. Flexible connectors.
 6. Vibration-control devices.
 7. Factory-insulated access panels and doors.

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply-Air Duct, Return-Air, Outside-Air, and Plenum Insulation: Fiberglass blanket, 2 inches thick and 0.75-lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulation for HVAC piping systems.
 - 1. Heating hot-water piping – indoors.
 - 2. Piping heat exchanger to snow melt manifold piping.
 - 3. Refrigerant suction and discharge piping, indoors and outdoors.

1.2 RELATED SECTIONS:

- A. Section 230714 – Duct insulation.

1.3 ACTION SUBMITTALS

- A. See Section 013300 for submittal requirements.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Surface Burning Characteristic: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation installed indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation installed Outdoors: Flame-spread index of 75 or less and smoke developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; Comply with ASTM C534/C534M, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. K-Flex USA.
- F. Fiberglass, Preformed Pipe Insulation:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway Company.
 - b. Knauf Insulation.
 - c. Owens Corning.
 - 2. Type I, 850 deg F Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I Grade A, with factory-applied ASJ-SSL.
 - 3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC
 - c. K-Flex USA
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice of the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers"
- C. Fiberglass Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H.B. Fuller Construction Products.
 - b. Eagle Bridges – Marathon Industries.
 - c. Foster Brand; H.B. Fuller Construction Products.
 2. For indoor applications, adhesive shall have a VOC content shall content of 80 g/L or less when calculated according to 40 CFR, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice of the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers"
- D. ASJ Adhesive and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H.B. Fuller Construction Products.
 - b. Eagle Bridges – Marathon Industries.
 - c. Foster Brand; H.B. Fuller Construction Products.
 2. For indoor applications, adhesive shall have a VOC content shall content of 50 g/L or less when calculated according to 40 CFR, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice of the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers"
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - b. Johns Manville; a Berkshire Hathaway Company
 - c. P.I.C Plastics, Inc.
 - d. Speedline Corporation.
 2. For indoor applications, adhesive shall have a VOC content shall content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice of the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers"

2.3 MASTICS

- A. For indoor applications, use mastics that have a VOC content of 50g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H.B. Fuller Construction Products.
 - b. Eagle Bridges – Marathon Industries.
 - c. Foster Brand; H.B. Fuller Construction Products.
 - d. Knauf Insulation.
 - 2. Water-Vapor Permeance: ASTM F1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: 60 percent by volume and 66 percent by weight.
 - 5. Color: White.

2.4 SEALANTS

- A. Joint Sealants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H.B. Fuller Construction Products.
 - b. Eagle Bridges – Marathon Industries.
 - c. Foster Brand; H.B. Fuller Construction Products.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - a. Service Temperature Range: Minus 100 to plus 300 deg F
 - b. Color: White or gray.
 - c. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - d. Sealants shall comply with the testing and product requirements of the California Department of Health Services “Standard Practice of the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers”
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H.B. Fuller Construction Products.
 - b. Eagle Bridges – Marathon Industries.
 - c. Foster Brand; H.B. Fuller Construction Products.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services “Standard Practice of the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers”.
- C. ASJ Flashing Sealants and PVDC and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H.B. Fuller Construction Products.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services "Standard Proactive of the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers".

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
 3. PVDC Jacket for indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E96/E96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E84.
 4. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E96/E96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway Company.
 - b. P.I.C. Plastics, Inc.
 - c. Proto Corporation.
 - d. Speedline Corporation.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

- C. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Childers Brand; H.B. Fuller Construction Products
 - b. ITW Insulation Systems, Illinois Tool Works, Inc.
 - c. RPR Products, Inc.
 - 2. Sheet and roll stock ready for shop or field sizing.
 - 3. Finish and thickness are indicated in field-applied jacket schedules.
 - 4. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - 5. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket.
 - 1) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 2) Tee covers.
 - 3) Flange and union covers.
 - 4) End caps.
 - 5) Beveled collars.
 - 6) Valve covers.
 - 7) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work included, but not limited to the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division.
 - b. Compac Corporation.
 - c. Ideal Tape Co., Inc. an American Biltrite Company.
 - d. Knauf Insulation.
 - e. Venture Tape.
 - f. P.I.C. Plastics,
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work included, but not limited to the following:
 - a. Compac Corporation.
 - b. Ideal Tape Co., Inc. an American Biltrite Company.
 - c. Venture Tape.

2.8 SECUREMENTS

- A. Aluminum Bands: Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch with wing seal or closed seal.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ITW Insulation Systems, Illinois Tool Works, Inc.
 - b. RPR Products, Inc.
- B. Staples: Outward-clinching insulation staples, nominal 3/4 inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work included, but not limited to the following:
 - a. C & F Wire.

2.9 INSULATION COVERS

- A. Subject to compliance with requirements. Provide one of the following:
 - 1. LIT Industries
 - 2. Insultech
 - 3. Thermal Energy Products
- B. Interior Fabric: Silicone or Teflon coated fiberglass cloth. Temperature rating –80° F to 500°F
- C. Insulation Filler/Properties: One (1") inch thick high density needled fiberglass mat insulation. maximum temperature Rating to 299°F.
- D. Exterior Fabric/Properties: Silicone or Teflon coated fiberglass cloth. Temperature rating 0°F to 299°F
- E. Securement: Stainless steel buckles lacing hardware and strap assembly
- F. Sewing Thread: Kevlar
- G. Identification Tag: All insulation covers assemblies shall be labeled with a 1.50" x 3.5" aluminum tag with raised imprinted lettering. The tagging systems will facilitate installation and reinstallation of all blankets and enable us to provide replacements upon request by number assigned as imprinted on the label.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
 - 3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its normal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor

- insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
 - D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
 - E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078400 "Firestopping" for firestopping and fire-resistive joint sealers.
 - F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 "Firestopping."
- 3.4 GENERAL PIPE INSULATION INSTALLATION
- A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.
 - B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than two (2) times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation

- and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than two (2) times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
- ### 3.5 INSTALLATION OF CELLULAR-GLASS INSULATION
- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
 4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install prefabricated pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install prefabricated sections of cellular-glass insulation to valve body.
 2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
- 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION
- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
 - 2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF FIBERGLASS PREFORMED PIPE INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
 - 4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install prefabricated pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
 - 2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF FIELD-APPLIED JACKETS

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive. directly over bare insulation or insulation with factory-applied jackets.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under the lap and the finish bead along seam and joint edge.
 - 2. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by the insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

- A. Pipe insulation with ASJ or other paintable Jacket Materials: Paint jacket with paint system identified below and as specified in Section 099000 "Painting and Coating".
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and inspections.
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and discharge piping: Flexible elastomeric, 1" thick.
- B. Heating water piping insulation shall be the following:
 - 1. Fiberglass: 1 ½-inch thick and larger – 2" thick.
 - 2. Fiberglass: 1 ¼-inch and smaller – 1 ½" thick

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Liquid Piping insulation shall be the following:
 - 1. Flexible Elastomeric: 2" thick with embossed aluminum jacket.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
- D. Piping, Exposed in the Interior Wash Bay:
 - 1. PVC: 30 mils thick, provide architect with physical color samples
- E. Piping, Exposed that is not in the Interior Wash Bay:
 - 1. Aluminum, Embossed Jacket: 0.016 inch thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Jacket shall be the following for all insulated outdoor piping:
 - 1. Aluminum, Stucco Embossed: 0.020 inch thick.

3.16 PIPING COMPONENT INSULATION

- A. Piping components to be insulated with removeable insulation covers include the following:
 - 1. Strainers, that are not on VAV boxes.
 - 2. All triple duty valves.
 - 3. All suction diffusers.
 - 4. All control valve bodies.
 - 5. Valves greater than 2".
 - 6. Pipe blind flange.

END OF SECTION 230719

SECTION 230800 – MECHANICAL SYSTEMS COMMISSIONING

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED WORK

- A. All other sections in Division 21, 22, and 23.
- B. Specification Section 019133 -- “General Commissioning Requirements.”
- C. Specification Section 260800 - “Electrical Systems Commissioning
- D. Specification Section 220800 – “Plumbing Systems Commissioning”.

1.2 DEFINITIONS

- 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 and associated electrical systems have been installed in the prescribed manner, and operates within the performance guidelines set in the design intent. The Commissioning Authority (CxA) shall provide the Owner with an unbiased, objective view of the system 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.

1.3 SCOPE

- A. The HVAC 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 Owners’ project requirements (ORP) and the Construction Documents (CD). The commissioning process shall demonstrate that each piece of equipment is performing and operating to the OPR and CDs.
- B. Participants in HVAC Systems Commissioning: HVAC systems shall be conducted with representatives from the following entities (the required participants shall be confirmed with the commissioning agent prior to scheduling the commissioning).
 - 1. General Contractor
 - 2. Mechanical Contractor
 - 3. Building Management System “BMS” or ATC Contractor
 - 4. Electrical Contractor
 - 5. Test and Balance Contractor
 - 6. Owner’s Representative.
- C. Major Pieces of Equipment shall be defined as (while this list is meant to show a representative sample, any equipment that uses energy for heating water or moving water shall be considered as major):

1. Air Handling Units.
 2. Variable Frequency Drives.
 3. Exhaust Fans
 4. Building Management System "BMS" or ATC Controls.
 5. Relief Fans.
 6. Makeup Air Units.
 7. Unit Heaters.
 8. Vertical Heat Pumps.
 9. Ductless Split Systems.
- D. Kickoff, Coordination and MEP Meeting.
1. The CxA will attend the contractors sub meeting to discuss any issue items.
 2. Other meetings such as the Commissioning Kick-Off meeting, controls meeting, and other coordination meetings shall be attended by those participants as indicated in the "Participants in HVAC Systems Commissioning."
- E. Submittal Review and Meetings.
1. The CxA shall review each submittal in Division 23.
 2. Submittal reviews are NOT an approval but a courtesy review to help validate products submitted are in general compliance with the construction documents.
- F. Issues Log.
1. An "issues log" shall be kept by the CxA. The issues log will identify issues, defects, improper installations, and deficiencies of the installation and design. The issues log will have the issue, a potential resolution, the subcontractor responsible, the date the issue was found, and the CxA who found the issue.
 2. The issue log shall be immediately addressed every week by the contractor.
 3. When an item is completed and addressed by the contractor or subcontractor 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.
- G. Construction Checklist. Pre and final functional testing checklist and start-up checklists.
1. The CxA shall develop construction checklists that will be executed by the CxA. The contractors and sub-contractors shall review the checklists for compliance with the ability of their individual systems. If the contractor or subcontractor does 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 subcontractor has not in writing opposed such test, then the contractor or subcontractor shall be liable for any damages and delays.
 2. The contractor shall fill out checklists and "Contractor Readiness Checklists" (CRC). These shall be delivered in the commissioning plan and shall be used to show the CxA that the contractor is ready for Final Commissioning (FAT.)
 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 HVAC 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 the addressed in writing prior to requesting a date for the recommissioning. 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.

H. Access to BMS

1. The BMS contractor shall give the CxA their own password and user name for their system.
2. The Contractor shall also give "Admin" access to the CxA to change settings, review programming, and review graphics.

1.4 SYSTEMS TO BE COMMISSIONED

- A. This list is not intended to be exhaustive. All Division 23 and any equipment, piping, balancing, controls, etc. that are defined in the entire cumulative sections of Division 23 will go through commissioning. The list below is a representative sample of items that are typically commissioned.
1. Mechanical systems including electrical that connects to mechanical.
 2. Variable frequency drives.
 3. Refrigerant equipment.
 4. Ventilation equipment.
 5. ATC control systems, hardware, software, and documentation.
 6. All mechanical and HVAC Systems.
 7. Any other mechanical system specified in the specifications, contractor documents, and program documents.

1.5 COORDINATION

- A. The Commissioning authority shall receive a copy of all construction documents, addenda, change orders, and appropriate approved submittals and show drawings directly from the Contractor. We only use this documentation for our review, but 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 the progress, pending problems and/or disputes, and shall provide regular status reports on the progress with each system. Any potential change in the contractual and/or financial obligations of the Owner (credit, change orders, schedule changes, etc.) shall be identified and qualified as soon as possible.
- D. The Commissioning Authority shall coordinate the schedule of commissioning activities with the construction schedule. It is possible that procedures will be completed before the entire mechanical system is completed.

1.6 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 Checklist are delivered to the CxA.
- B. Pre-Functional Commissioning shall commence during the progress of the project. Contractor Readiness checklists 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 coordinate commissioning scheduling information with the contractor for review and planning activities.
- D. The following list is a general set of tasks and criteria along with the approximate duration for each task in regards to the CxA activities. This list is intended to be utilized as a guideline for creating an appropriate schedule for all of the work related to HVAC systems commissioning. Three of these activities can be commissioned concurrently at one time. These activities do not include the PFAT systems. The activities do not include issues that will take additional days to fix.
 - 1. PFAT Systems – PFATs will be completed within 10 business days of the contractor notice to CxA to start. We expect these systems to be split up and not told to inspect ALL systems at one time. These will be completed during the typical construction schedule and before startup.
 - 2. Test and balance verification – This will take 5 business days for initial review. It will take an additional 3 days after functional testing.
 - 3. Exhaust fan functional testing – 2 business days.
 - 4. Point to point controls testing – 5 business days.
 - 5. Sequence of operations functional testing – 5 business days.

1.7 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 the interpretation of construction and documentation, the final responsibility rests solely on the General and Installation Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 COMMISSIONING KICK-OFF MEETING

- A. The CxA shall facilitate a Commissioning Kick-off meeting after all mechanical, electrical, and plumbing subcontractors are under contract with the General Contractor. The CxA shall invite the Architect, Engineers, and Owner's 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 Plumbing 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 in attendance.

3.2 DISTRIBUTION LIST

- A. A distribution list shall be developed during the Commissioning Kick-off 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 subcontractors by the CxA, the sole responsibility for the subcontractors to receive information rest on the General Contractor.

3.3 COMMISSIONING PLAN

- A. The Commissioning Pan 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 checklists, the FAT checklists, and the Contractor Readiness checklists.
- C. The subcontractors and contractors are responsible for reviewing the above checklists and provide comments to the CxA within 30 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 subcontractors to ensure the safety of systems.

3.4 SUBMITTAL REVIEWS

- A. The CxA shall review all mechanical submittals. It is the responsibility of the contractor to ensure they receive the CxA reviews. The Architect is responsible to coordinate the submittals with the CxA,
- B. The submittals will be marked with REVIEWED as noted. Defer to Engineer, Note, or Revise and Resubmit. Only Revise and Resubmit items will have the expectation of a re-submittal.

3.5 COORDINATION MEETING (MEP MEETINGS)

- A. The CxA shall attend the contractors MEP meeting every other week.
- B. The purpose of these meeting is to coordinate installation, commissioning, and testing activities. These meeting will be conducted by the contractor.

3.6 CONSTRUCTION OBSERVATION AND FIRST INSTALLS

- A. The CxA shall observe construction activities throughout the construction of the project. Schedule observations and coordinate with GNC. The
- B. issues log as outlined in Part 1, shall be kept by the CxA.
- C. Mockups, or first installations of individual pieces of equipment, need to be installed in there location where applicable. First installs shall be required by the contractor and subcontractor for the following items:
 - 1. Piping and Hangers (Racks of pipes and individual pipes.)
 - 2. Piping and Duct Insulation (Overhead and in-wall).
 - 3. Duct and Hangers.
 - 4. Pumps.
 - 5. Expansion Tanks.
 - 6. Exhaust Fans.
 - 7. Rooftop Units.
- D. Contractor shall coordinate and not prohibit observations and first installs. Subcontractors, Owner's representatives, and engineers shall review the first installs for compliance.

3.7 CONTRACTORS READINESS CHECKLIST

- A. Contractor Readiness Checklists shall be delivered to the CxA to the contracting team for the contracting team to complete. The purpose of the CRC is to inform the CxA of the readiness of the contractor to begin functional testing on the mechanical system.
- B. The CxA shall not begin function test the system or any equipment until the CRCs have been 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 completed for 80 heat pumps.)

3.8 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 HVAC system installations.

3.9 FUNCTIONAL ACCEPTANCE TESTING

- A. The CxA shall execute Functional Acceptance Testing with the attendance of suppliers, BMS or ATC Contractor, Mechanical Contractor, Electrical Contractor, Test and Balances Contractor and Plumbing Contractor at the request of the CxA. This includes

Point-to-Point testing which shall be performed with the Controls Contractor on-site the ENTIRE time.

- 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. Included are 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 subcontractors for technical dept, clarity of documentation completeness of information. Emphasis shall be placed on testing procedures that shall determine actual systems performance and compliance with the design intent.
 - C. The Commissioning Authority shall determine the acceptance procedures for each system within MEP divisions as required. The acceptance procedures shall incorporate the commissioning standards and successful testing results as referred to throughout the mechanical and electrical specifications.
 - 1. In particular, the temperature control system shall have all I/O (input/output) points individually verified for proper function, calibration, and operation. The Commissioning Authority shall review proposed testing procedures and report formats, and observe sufficient field testing to confirm that all I/O points have been properly tested.
 - 2. All control sequence of operation strategies, alarm generation and reporting shall also be reviewed and proper operation verified by the Commissioning Authority.
 - 3. The central work station graphics, point assignments, alarm messages, and logging functions shall be verified.
 - 4. All major pieces of mechanical equipment shall go through functional testing.
 - 5. Test and balance verification.
 - 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 specific system.
 - E. Acceptance procedure 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. The BMS or ATC contractor shall be in attendance throughout the Sequence of Operation checks, which we expect to take 1 day if all sequences function as per contract documents.
 - G. The CxA shall review 100% and test 100% of HVAC systems.
- 3.10 TRENDING
- A. Trending points shall be outlined in the Procedural Standards as delivered by the CxA in the commissioning plan.

- B. A minimum of 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 already defined in the contract documents. Trends shall be coincident at 15m minute intervals with a cache able to handle four 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 shall review the trends after the four weeks of clean trending.

3.11 OPERATION MAINTENANCE MANUALS

- A. 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.
- B. The final O&M must be delivered to the Owner before training shall commence and it shall be one of the requirements for Substantial Completion.

3.12 TRAINING

- A. The CxA shall be invited to all HVAC 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 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 philosophy, troubleshooting and repair techniques.

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

3.13 RECORD DRAWINGS OR REDLINES

- A. The CxA shall review the “Redlines” or “Record Drawings” on a bi-weekly basis, or as requested.
- B. Record Drawings or Redlines shall be kept in a printed format above and beyond any BIM modeling. If record drawings are being kept on BIM a printed 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 met for Redlines or Record Drawings:
 - 1. Per specifications elsewhere defined.
- D. The final redlines shall be reviewed by the CxA before delivery to the Architect.

3.14 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.

3.15 REPEATED WORK, TESTING, AND REVIEWS

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

END OF SECTION 230800

SECTION 230900 – DIRECT DIGITAL CONTROLS SYSTEM**PART 1 - OWNER'S GENERAL
REQUIREMENTS****1.1 GENERAL**

- A. The control system shall provide direct digital control (DDC) with Windows based user interface. 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. All control system equipment is to be Alerton, who shall be recognized by Alerton as an approved "Associate Dealer" and shall be as follows:
 - 1. Alerton by: Building Control Services, Inc. (775) 826-8998
 - 2. No Exceptions.
- B. Furnish and install microprocessor-based energy management and control system (EMCS) as an extension to the existing Alerton EMCS System at the Washoe County School District Plant Operations.

1.2 HARDWARE

- A. Controllers:
 - 1. BACnet MS/TP LAN must be software-configured from 9.6 to 115.4Kbps.
 - a. Each BACnet MS/TP LAN shall support 64 BACnet devices at a minimum.
 - b. All property object types, if used in the system, shall be thoroughly documented, and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
 - c. All controllers (except application-specific for heat pumps) shall be furnished with a minimum of 10 percent spare capacity to allow for addition of both analog and digital inputs and outputs.

1.3 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 set points, 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 omitted from the Mechanical Engineer's written control sequences and shall be provided by the Temperature Control Contractor at no additional cost to the Owner.) The written control sequences, initial set points and dead-bands shall all be reviewed and confirmed with the Engineer.
- B. After all temperature control sequences have been finalized and have been approved by the Engineer (and after the HVAC systems commissioning process has been completed) the Contractor shall provide as-built documentation which shall include written control sequences. Written control sequences shall be provided both in hard copy and on diskette.

1.4 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, but not be limited to, calibration of all sensors and other devices, adjustment to set points and modifications to control sequences or programming as required/desired to fine-tune and/or finalize all control sequences.

1.5 TRAINING

- A. Upon completion of work, 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 sequences 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 twelve total hours (consisting of three separate 4- hours sessions.)

1.6 EMCS SOFTWARE AND PROGRAMMING REQUIREMENTS

- A. Provide a security/password system with two passwords systems with two passwords of up to four characters each. The security/password system shall access based on four levels of security as follows:
 - 1. Level 1 viewing only.
 - 2. Level 2 Room temperature adjustment.
 - 3. Level 3 Adjustment of all set points.
 - 4. Level 4 full access to all set points and programming.
- B. No set points related to the equipment control sequences or programming shall be accessible by anyone other than the Temperature Control Contractor during the commissioning and warranty period.
- C. The Temperature Control Contractor shall program the eleven School District Holidays into the EMCS software for the three years following the date of installation. The eleven School District Holidays each year are as follows:

1. New Year's Day	January 1
2. Martin Luther King, Jr's Birthday	Third Monday in January
3. President's Day	Third Monday in February
4. Memorial Day	Last Monday in May
5. Independence Day	July 4 th
6. Labor Day	First Monday in September
7. Nevada Day	Last Friday in October
8. Veteran's Day	November 11
9. Thanksgiving Day	Fourth Thursday in November
10. Family Day	Friday following Thanksgiving
11. Christmas Day	December 25 th

When January 1, July 4, November 11 or December 25 falls on a Saturday, the preceding Friday is the observed holiday. If these days fall on Sunday, the following Monday is the observed holiday.

- D. Equipment schedules – A separate occupied/unoccupied schedule shall be provided for each heat pump, air handling unit, fan coil or other individual air handling systems. A graphic display shall be provided to allow for access to each of the schedules from the display screen.

1.7 GRAPHIC DISPLAYS

- A. All temperature set points and all other set points identified as adjustable shall be adjustable from the appropriate graphic displays. Set points given in the control sequences are for initial set-up and trial of system operations. Control system shop drawing shall utilize the same (or similar) written sequences with all set points, throttling ranges and differentials identified. As-built drawing shall include this same information with actual set points following start-up, 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 shall be dynamic (animated). All graphic displays shall be submitted to the Engineer for review and approval prior to commencing any programming for the temperature controls. Graphic displays shall be developed for a screen resolution of 800 x 600 unless otherwise agreed upon in writing.
- C. All temperatures shall be displayed with zero decimal places.
- D. All valves and damper positions shall be displayed as percent open and shall be displayed with zero decimal places.
- E. All set points which are identified as "adjustable" in written control sequences shall be adjustable via the associated graphic displays (including dead band between and cooling room set point.)
- F. All occupied mode and unoccupied mode room temperature set points shall have an adjustable dead band (adjustable from the associated graphic display).
- G. All displays specified to be dynamic shall depict motion (as a minimum dynamic display shall include rotating fan wheels and rotating pump impellers.)
- H. All set points adjustable from the graphic displays shall be programmed with the dead band on one side of the set point (not split evenly across the set point - unless otherwise specified.)
- I. Zone Temperature Summary – Provide a summary screen which indicates the current room temperature set point and current room temperature for each zone. The screen shall have a global room temperature set point capability that will override the current/individual set point for all zones. Each zone shall be capable of being set to either the global set point or to a separate individual set point. By selecting any of the zones on the screen there shall be the capability to transfer to the selected zones' equipment control screen and back. The zone summary screen shall also include additional information such as discharge air temperature, valve position, fan status, etc. (these requirements shall be coordinated with the Owner prior to developing graphic displays.)
- J. Floor Plans – Provide a display showing the building floor plans, all space temperature sensors, and the equipment associated with each zone (with the zone borders depicted on the floor plan.) The necessary AutoCAD drawing file will be furnished to the Temperature Control Contractor by the Mechanical Engineer upon request.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved manufacturers subject to compliance with requirements: (See Part 3- Execution, General, 01)
 - 1. Alerton Technologies to match existing school district systems, no exceptions.

2.2 MATERIALS AND EQUIPMENT

A. General:

1. Provide a distribution processing system complete with Direct Digital Control (DDC) software. The system shall be a fully integrated package of control and instrumentation to control all heat pumps, valves, fans, pumps, etc., directly without intervening conventional controls. Control system components shall be manufacturer's standard as indicated through published product information, designed, and constructed as recommended by the manufacturer.

B. System Architecture

1. The system shall be a complete stand-alone energy management and control system consisting of state-of-the-art menu-driven technology, dynamic graphics, and simple user- friendly operation, completely programmable and highly modular in construction.
2. The basic elements shall be built up of standard components kept in inventory by the EMCS supplier. Components shall not require customizing other than setting jumpers and switches, adding firmware modules or software programming to perform required functions.
3. The system shall be a true distributed processing system with all software control functions to be performed by the remote field panels. Control software shall be in nonvolatile memory. System shall provide "on-line" programming by both "local" and "remote" computer terminals allowing any and all data to be changed, added, deleted, etc., from either terminal. Remote field computers shall communicate with the central processor and the terminal unit control panels.

C. Global Controller.

1. BACnet Conformance
 - a. Building Controller shall be approved by the BTL as meeting BACnet Building Controller requirements.
 - b. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented, and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information
2. Building controller shall be of scalable design such that the number of trunks and protocols may be selected to fit the specific requirements of a given project.
3. The controller shall be capable of panel-mounted on DIN rail and/or mounting screws.
4. The controller shall be capable of providing global control strategies for the system based on information from any objects in the system, regardless if the object is directly monitored by the building controller module or by another controller.
5. The controller shall be capable of running up to six (6) independent control strategies simultaneously. The modification of one control strategy does not interrupt the function or runtime of others.
6. The software program implementing the DDC strategies shall be completely flexible and user-definable. All software tools necessary for programming shall be provided as part of the project software. Any systems utilizing factory pre-

- programmed global strategies that cannot be modified by field personnel on-site, using a wide area network (WAN) or downloaded through remote communications are not acceptable. Changing global strategies using firmware changes are also unacceptable.
7. Programming shall be object oriented using control function blocks and support DDC functions. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.
 8. The programming tool shall provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed using the operator's workstation or field computer.
 9. Controller shall have 6,000 Analog Values and 6,000 Binary Values.
 10. Controller IP configuration can be done via a direct USB connect with an operator's workstation or field computer.
 11. Controller shall have at a minimum a Quad Core 996Ghz processor to ensure fast processing speeds.
 12. Global control algorithms and automated control functions shall execute using a 64-bit processor.
 13. Controller shall have a minimum of GB of DDR3 SDRAM on a 533Mhz bus to ensure high speed data recording, large data storage capacity and reliability.
 14. Controller shall support two (2) on-board EIA-485 ports capable of supporting various EIA-485 protocols including, but not limited to BACnet MS/TP and Modbus.
 - a. Ports are capable of supporting various EIA-485 protocols including, but not limited to BACnet MS/TP and Modbus.
 15. Controller shall support two (2) ports-each of gigabit speed- Ethernet (10/100/1000) ports.
 - a. Ports are capable of supporting various Ethernet protocols including, but not limited to BACnet IP, FOX, and Modbus.
 16. All ports shall be capable of having protocol(s) assigned to utilize the port's physical connection.
 17. The controller shall have at a minimum four (4) on-board inputs, two (2) universal inputs and two (2) binary inputs.
 18. Schedules.
 - a. Building controller modules shall provide normal seven-day scheduling, holiday scheduling and event scheduling.
 - b. Each building controller shall support a minimum of 380 BACnet Schedule Objects and 380 BACnet Calendar Objects.
 19. Logging Capabilities.
 - a. Each building controller shall log as minimum 2,000 objects at 15-minute intervals. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
 - b. Logs may be viewed both on-site or off-site using WAN or remote communication.
 - c. Building controller shall periodically upload trended data to network operator's workstation for long term archiving of desired.
 - d. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.
 20. Alarm Generation
 - a. Alarms may be generated within the system for any object change of value or state (either real or calculated). This includes things such as

- analog object value changes, binary object state changes, and various controller communication failures.
 - b. Each alarm may be dialed out as noted elsewhere.
 - c. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
 - d. Controller must be able to handle up to 2,000 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.
 - 21. DDC Terminal Unit Controller
 - a. Each controller shall be microprocessor based and communicate with its respective GC and also be stand-alone maintaining its own control strategy in the event of communication failure with the GC or remote computer terminals. Each controller shall contain RAM and ROM and be capable of controlling heat pumps, boilers, cooling towers, pumps etc., as specified in control sequence. Inputs shall be either analog or digital. Momentary type switch closure allows an input to be both analog and digital. Outputs shall be analog or digital with LED's provided to indicate status. Each controller is linked serially by a pair of wires and communicates to its respective GC at 4800 baud. Controllers default to last programmed temperature or to fixed operator selectable control whenever communication to GC is lost. Default mode shall be field changeable. All operating modes (except default) ad set points shall be modified at the computer terminals. Each unit shall allow complete calibration of all temperatures.
 - b. System shall be capable of accomplishing any controller to controller command within a maximum of 1 second.
- D. OA Temperature Sensor:
 - 1. Sensor shall be pre-calibrated Thermistor type resistance element complete with terminal housing and sensor shield.
- E. Immersion Temperature Sensor
 - 1. Sensor shall be similar to OA sensor, except a stainless steel well shall be included providing sensor with fluid contract and capability for sensor removal without draining system.
- F. Current Sensors shall be as follows
 - 1. Current sensors shall be digital type and shall have the capability to transmit the actual system reading.
- G. Duct Temperature Sensor
 - 1. Sensor shall be similar to OA sensor where used in ducts not to exceed 36 inches.
- H. Duct Temperature Sensor
 - 1. Sensor shall be similar to (I); except the sensor shall be averaging type with mechanical support across the duct section when used in ducts over 36" wide.
- I. Room Temperature Sensor
 - 1. Sensor shall contain temperature sensing element. Controller shall allow occupants to raise and lower set point and to activate heat pump for override use within limits programmed by building operator. Controller shall allow service technician access following a password entry to view and change any data relative to service, maintenance, and operation of the heat pump control. Provide

service tool to check data for each individual heat pump from its thermostat Mount at +4'-6" AFF.

- J. Control Valves
 - 1. Heat pump control valves shall be Belimo Characterized Control Valves (CCV) 2-way automatic control valves with stainless steel ball, stem, and electronic actuators.
- K. Relays
 - 1. Relays shall be plug-in type complete with sockets for panel mounting. Poles shall be required and contact rated for intended use.
- L. Damper Actuator
 - 1. Actuator shall be by Belimo with permanently lubricated gear-train sealed in duct tight enclosure. Actuator shall be sized to handle intended load plus 10%. Heat motors will not be acceptable.
- M. Control Dampers
 - 1. Control dampers shall be low leakage type with extruded bladed seals and flexible metal jamb seals. Leakage rating when tested in accordance with AMCA standard shall not exceed 10 cfm/ft² at 4.0" H₂O pressure.
 - 2. Control dampers are to be provided and installed by Mechanical Contractor, control damper actuators to be provided and installed by Temperature Control Contractor.
- N. Gas Monitors
 - 1. Gas monitor for CO₂ and combustibles shall be stand along type utilizing an electrochemical cell (for toxic gas monitoring) or a catalytic combustion cell (for explosive gas monitoring.) Gas monitor shall have an analog output for input to EMCS system. Gas monitor shall also have two (2) alarm relays. Monitor shall be Honeywell Analytics Model E3SM with appropriate Sensor Cartridge for all gases except CO₂ which shall be Honeywell Analytics IAQPoint2.
- O. Software
 - 1. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software functions delivered on this project shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, and a full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited. All software required to program application specific controller and all field level devices and controllers will be left with the owner. All software passwords required to program and make future changes to the system will also become the property of the owner. All software required to make any program changes anywhere in the system, along with scheduling and trending applications, will be left with the owner. All software passwords required to program and make future changes to scheduled, trends and related program changes will also become the property of the owner. All software required for all field engineering tools including graphical programming and applications will be left with the owner. All software passwords required to program and make future changed to field engineering tools, including graphical programming and applications will be left with the owner.

PART 3 - INSTALLATION

3.1 GENERAL

- A. By "Alerton Technologies" by Building Control Services, Inc. no exceptions.
- B. Interlock and Control Wiring
 - 1. Installation shall be in a neat and workman like manner with all runs parallel to or perpendicular to building lines.
 - 2. All wiring walls shall be in EMT. In ceiling areas above finished ceilings, exposed "plenum rated cabling" without raceways shall be permissible, where code permits. Cabling shall be supported above finished ceiling as high as permissible in a neat and workmanship like manner. Cabling shall not lie on top of finished ceiling.
 - 3. "Plenum Rated" cabling shall be identified as follows:
 - a. "EMS Communication" cabling shall be "raspberry" in color and identified on cabling jacket every three (3) feet-minimum.
 - b. "EMS Sensor" cabling shall be "blue" in color and identified on cabling jacket every three (3) feet-minimum.
 - c. Installation shall be in accordance with manufacturers written instructions and with recognized industry standards.
 - d. All wiring shall be in conformance with all local and national code requirements.
 - e. Verify all room sensor locations in the field prior to installation and relocate as required at no cost to the owner.
- C. Control Panels
 - 1. Mount controllers, relays, and switches, etc. for equipment located in equipment rooms in enclosed control panels with hinged doors. Control devices for equipment located in exposed areas subject to outside weather conditions shall be mounted inside weatherproof enclosures. Location of each panel shall be convenient for adjustment service. Provide plastic nameplates at each panel-mounted control device describing function of device.
 - 2. Prewire electrical devices within the panel to number interdevice within panel completed prior to installation. Terminal numbers to match terminals shown on control diagram.
 - 3. Coordinate with Division 23 and 26, including power distribution and mechanical and electrical equipment, as necessary to properly interface installation.
 - 4. Adjust and validate all thermostats, sensors, controllers, relays, etc., provided, and complete system validation forms attached in conjunction with WCSD Personnel.
 - 5. Validation forms shall be completed and furnished to test and balance contractor for inclusion in final report prior to final inspection and be provided to commissioning agent.

3.2 ADJUSTMENT

- A. Adjust and validate all thermostats, sensors, controllers, relays, etc., provided, and complete system validation forms attached in conjunction with Owner's representative. Provide complete 24 hour printed logs to owner for all equipment operations and system functions as part of acceptance. Thirty days prior to first year warranty anniversary date, provide a duplicate series of validation logs in cooperation with owner's representative. Initial validation complete with all logs shall be included with

“Operation and Maintenance Manuals.” Copies of all additional logs shall be furnished to Engineer at same time they are furnished to Owner.

1. Items to be logged include:
 - a. Heat pump loop supply water.
 - b. Heat pumps; operating temperatures.
2. Specific problem areas requested by Building Operations Engineer.
3. Copies of each log complete with analysis shall be furnished to commissioning agency.

3.3 INSTRUCTION

- A. Furnish instruction manuals covering functions and operation of control systems for use by Owner’s operating personnel. A field instruction period lasting not less than two (2) 8-hour days shall be provided followed by one (1) 8-hour day approximately 30 days later.
- B. Provide control diagrams, reduce as required, diagrams shall equipment, controls, etc., marked to correspond to identification on equipment.
- C. Control Contractor shall maintain terminal and printer in his office to communicate with jobsite and for system troubleshooting, fine tubing system set points and assistance to owner on-site personnel.
- D. Provide vandal proof type sensors or covers on all devices exposed to public.

3.4 Commissioning

- A. Control Contractor shall meet all requirements outlined by Commissioning agent as described in specification.

PART 4 - WARRANTY

4.1 GENERAL

- A. Provide one-year unconditional warranty on all material, software and labor furnished and installed under this contract from date of substantial completion.
- B. Provide and install any software updates and software changes for the site required by owner occurring during warranty period without charge.

END OF SECTION 230900

SECTION 230923.12 - CONTROL DAMPERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes control dampers and actuators for DDC systems.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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.
- B. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

2.2 RECTANGULAR CONTROL DAMPERS

- A. General Requirements:
 - 1. Unless otherwise indicated, use parallel blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed blade configuration.
 - 2. Factory assemble multiple damper sections to provide a single damper assembly of size required by the application.
- B. Manufacturers: Basis of design product, subject to compliance with the specified product on the drawings. Provide a product by the following manufacturers:
 - a. Greenheck.
 - b. Pottorff.
 - c. Or approved equal.
- C. Rectangular Dampers with Aluminum Airfoil Blades:
 - 1. Performance:
 - a. Leakage: AMCA 511, Class 1A. Leakage shall not exceed 3 cfm/sq. ft. against 1-in. wg differential static pressure.
 - b. Pressure Drop: 0.05-in. wg at 1500 fpm across a 24-by-24-inch damper when tested according to AMCA 500-D, figure 5.3.
 - c. Velocity: Up to 6000 fpm.

- d. Temperature: Minus 40 to plus 185 deg F.
- e. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
- f. Damper shall have AMCA seal for both air leakage and air performance.
- 2. Construction:
 - a. Frame:
 - 1) Material: ASTM B211, Alloy 6063 T5 extruded-aluminum profiles, 0.07 inch thick.
 - 2) Hat-shaped channel with integral flange(s). Mating face shall be a minimum of 1 inch.
 - 3) Width not less than 5 inches.
 - b. Blades:
 - 1) Hollow, airfoil, extruded aluminum.
 - 2) Parallel or opposed blade configuration as required by application.
 - 3) Material: ASTM B211, Alloy 6063 T5 aluminum, 0.07 inch thick.
 - 4) Width not to exceed 6 inches.
 - 5) Length as required by close-off pressure, not to exceed 48 inches.
 - c. Seals:
 - 1) Blades: Replaceable, mechanically attached extruded silicone, vinyl, or plastic composite.
 - 2) Jambs: Stainless steel, compression type.
 - d. Axles: 0.5-inch- diameter stainless steel, mechanically attached to blades.
 - e. Bearings:
 - 1) Molded synthetic or stainless-steel sleeve mounted in frame.
 - 2) Where blade axles are installed in vertical position, provide thrust bearings.
 - f. Linkage:
 - 1) Concealed in frame.
 - 2) Constructed of aluminum and stainless steel.
 - 3) Hardware: Stainless steel.
 - g. Transition:
 - 1) For round and flat oval duct applications, provide damper assembly with integral transitions to mate to adjoining field connection.
 - 2) Factory mount damper in a sleeve with a close transition to mate to field connection.
 - 3) Damper size and sleeve shall be connection size plus 2 inches.
 - 4) Sleeve length shall be not less than 12 inches for dampers without jackshafts and shall be not less than 16 inches for dampers with jackshafts.
 - 5) Sleeve material shall match adjacent duct.

2.3 GENERAL CONTROL-DAMPER ACTUATORS REQUIREMENTS

- A. Actuators shall operate related damper(s) with sufficient reserve power to provide smooth modulating action or two-position action and proper speed of response at velocity and pressure conditions to which the damper is subjected.
- B. Actuators shall produce sufficient power and torque to close off against the maximum system pressures encountered. Actuators shall be sized to close off against the fan shutoff pressure as a minimum requirement.

- C. The total damper area operated by an actuator shall not exceed 80 percent of manufacturer's maximum area rating.
- D. Provide one actuator for each damper assembly where possible. Multiple actuators required to drive a single damper assembly shall operate in unison.
- E. Avoid the use of excessively oversized actuators which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.
- F. Use jackshafts and shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.
- G. Provide mounting hardware and linkages for connecting actuator to damper.
- H. Select actuators to fail in desired position in the event of a power failure.
- I. Actuator Fail Positions: As indicated below:
 - 1. Exhaust Air: Close.
 - 2. Outdoor Air: Close.
 - 3. Supply Air: Open.
 - 4. Return Air: Open.

2.4 ELECTRIC AND ELECTRONIC ACTUATORS

- A. Type: Motor operated, with or without gears, electric and electronic.
- B. Voltage:
 - 1. Actuator shall deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.
 - 2. Actuator shall function properly within a range of 85 to 120 percent of nameplate voltage.
- C. Construction:
 - 1. Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
 - 2. 100 up to 400 W: Gears ground steel, oil immersed, shaft-hardened steel running in bronze, copper alloy, or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel, or cast-aluminum housing.
 - 3. Greater Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.
- D. Field Adjustment:
 - 1. Spring return actuators shall be easily switchable from fail open to fail closed in the field without replacement.
 - 2. Provide gear-type actuators with an external manual adjustment mechanism to allow manual positioning of the damper when the actuator is not powered.
- E. Two-Position Actuators: Single direction, spring return or reversing type.
- F. Modulating Actuators:

1. Capable of stopping at all points across full range, and starting in either direction from any point in range.
 2. Control Input Signal:
 - a. Three Point, Tristate, or Floating Point: Clockwise and counter-clockwise inputs. One input drives actuator to open position, and other input drives actuator to close position. No signal of either input remains in last position.
 - b. Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for zero- to 10- or 2- to 10-V dc and 4- to 20-mA signals.
 - c. Pulse Width Modulation (PWM): Actuator drives to a specified position according to a pulse duration (length) of signal from a dry-contact closure, triac sink or source controller.
 - d. Programmable Multi-Function:
 - 1) Control input, position feedback, and running time shall be factory or field programmable.
 - 2) Diagnostic feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
 - 3) Service data, including at a minimum, number of hours powered and number of hours in motion.
- G. Position Feedback:
1. Equip two-position actuators with limits switches or other positive means of a position indication signal for remote monitoring of open and close position.
 2. Equip modulating actuators with a position feedback through current or voltage signal for remote monitoring.
 3. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.
- H. Fail-Safe:
1. Where indicated, provide actuator to fail to an end position.
 2. Internal spring return mechanism to drive controlled device to an end position (open or close) on loss of power.
 3. Batteries, capacitors, and other non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.
- I. Integral Overload Protection:
1. Provide against overload throughout the entire operating range in both directions.
 2. Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.
- J. Damper Attachment:
1. Unless otherwise required for damper interface, provide actuator designed to be directly coupled to damper shaft without need for connecting linkages.
 2. Attach actuator to damper drive shaft in a way that ensures maximum transfer of power and torque without slippage.
 3. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.
- K. Temperature and Humidity:

1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F.
 2. Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, non-condensing.
- L. Enclosure:
1. Suitable for ambient conditions encountered by application.
 2. NEMA 250, Type 2 for indoor and protected applications.
 3. NEMA 250, Type 4 or Type 4X for outdoor and unprotected applications.
 4. Provide actuator enclosure with a heater and controller where required by application.
- M. Stroke Time:
1. Operate damper from fully closed to fully open within seconds.
 2. Operate damper from fully open to fully closed within seconds.
 3. Select operating speed to be compatible with equipment and system operation.
 4. Actuators operating in smoke control systems comply with governing code and NFPA requirements.
- N. Sound:
1. Spring Return: 62 dBA.
 2. Non-Spring Return: 45 dBA.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Furnish and install products required to satisfy most stringent requirements indicated.
- B. Properly support dampers and actuators, tubing, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a force.
- C. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- D. Seal penetrations made in fire-rated and acoustically rated assemblies.
- E. Fastening Hardware:
1. Stillson wrenches, pliers, or other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
 2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
 3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.
- F. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required

for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.2 CONTROL DAMPERS

- A. Install smooth transitions, not exceeding 15 degrees, to dampers smaller than adjacent duct. Install transitions as close to damper as possible but at distance to avoid interference and impact to performance. Consult manufacturer for recommended clearance.
- B. Clearance:
 - 1. Locate dampers for easy access and provide separate support of dampers that cannot be handled by service personnel without hoisting mechanism.
 - 2. Install dampers with at least 24 inches of clear space on sides of dampers requiring service access.
- C. Service Access:
 - 1. Dampers and actuators shall be accessible for visual inspection and service.
 - 2. Install access door(s) in duct or equipment located upstream of damper to allow service personnel to hand clean any portion of damper, linkage, and actuator. Comply with requirements in Section 233300 "Air Duct Accessories."
- D. Install dampers straight and true, level in all planes, and square in all dimensions. Install supplementary structural steel reinforcement for large multiple-section dampers if factory support alone cannot handle loading.
- E. Attach actuator(s) to damper drive shaft.
- F. For duct-mounted and equipment-mounted dampers installed outside of equipment, install a visible and accessible indication of damper position from outside.

3.3 CHECKOUT PROCEDURES

- A. Control-Damper Checkout:
 - 1. Check installed products before continuity tests, leak tests, and calibration.
 - 2. Check dampers for proper location and accessibility.
 - 3. Verify that control dampers are installed correctly for flow direction.
 - 4. Verify that proper blade alignment, either parallel or opposed, has been provided.
 - 5. Verify that damper frame attachment is properly secured and sealed.
 - 6. Verify that damper actuator and linkage attachment are secure.
 - 7. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
 - 8. Verify that damper blade travel is unobstructed.

3.4 ADJUSTMENT, CALIBRATION, AND TESTING:

- A. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.
- B. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.

- C. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION 230923.12

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes pipe and fitting materials and joining methods for the following:
 - 1. Hot water heating piping.
 - 2. Makeup water piping.
 - 3. Air Vent piping.
 - 4. Safety valve inlet and outlet piping.
 - 5. Snow melt heating hot water piping.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. Product Data: For each type of the following:
 - 1. Pipe materials.
 - 2. Pipe fittings.
 - 3. Pipe joining materials.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality control reports.

1.4 QUALITY ASSURANCE

- A. ASME Compliance” Comply with ASME B31.9, “Building Services Piping,” for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressures and temperatures:
 - 1. Chilled-Water Piping: 150 psig.
 - 2. Heating hot water piping: 150 psig at 200 deg F.
 - 3. Make-up water piping: 80 psig at 150 deg F.
 - 4. Drain piping: 150 deg F.
 - 5. Air vent piping: 200 deg F.
 - 6. Safety valve inlet and outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS.

- A. Drawn-Temper Copper Tube: ASTM B88, Type L.

- B. Drawn-Temper Copper Tube: ASTM B88, Type M.
- C. Annealed-Temper Copper Tube: ASTM B88, Type K.
- D. Copper Fittings: ASME B16.22.
- E. Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A53/A53M black steel with plain ends; welded and seamless, Grade B, and schedule number as indicated in Part 3, "Piping Applications" Article.
- B. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3, "Piping Applications" Article.
- C. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- D. Cast iron flanges and flanged fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- E. Wrought cast and forged steel flanges and flanged fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections and facings:
 - 1. Material Group: 1.1
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.

2.4 JOINING MATERIALS

- A. Pipe flange gasket materials: Suitable for chemical and thermal conditions of piping systems contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
 - a. Full face type: For flat-face, Class 125, cast iron and cast bronze flanges.
 - b. Narrow face type: For raised face, Class 250, cast iron and steel flanges.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
 - 3. Solder filler metals: ASTM B32, lead free alloys. Include water flushable flux according to ASTM B813.
 - 4. Brazing filler metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
 - 5. Welding filler metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

- B. Dielectric Unions:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Precision Plumbing Products (PPP) Clearflow.
 - b. MIFAB MI-DE.
 - 2. Description:
 - a. Standard: ASTM F1545.
 - b. Pressure Rating: 300 psig minimum at 225 deg F.
 - c. End connections: Threaded.

2.6 VALVES

- A. Check, ball, and butterfly valves: Comply with requirements specified in Division 23 Section "Valves".
- B. Automatic temperature control valves, actuators, and sensors: Comply with requirements specified in Division 23 Section "HVAC Instrumentation and Controls." See editing instruction No. 1, in evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 – Product requirements.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot-Water Heating, aboveground shall be the following:
 - 1. Sizes up to 1 ½": ASTM B88, Type "L", hard drawn copper with wrought-copper solder joint fittings.
 - 2. Sizes up to 2 to 2 ½": ASTM B88, Type "L", hard drawn copper with wrought-copper brazed joint fittings.
 - 3. Sizes over 3": ASTM A53, Schedule 40, 0.375 wall for sizes over 10", black steel with welded joints. Victaulic (grooved) couplings are not acceptable.
- B. Makeup-water piping installed aboveground shall be the following:
 - 1. Type "L", drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- C. Air-Vent Piping:
 - 1. Inlet: Same as service were installed with metal-to-plastic transition fittings for plastic piping systems, according to piping manufacturer's written instructions.
 - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- D. Safety-valved inlet and outlet piping for hot water piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems, according to piping manufacturer's written instructions.

3.2 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Section 230523.12 "Ball Valves for HVAC Piping", Section 230523.13 "Butterfly Valves for HVAC Piping", and Section 230523.14 "Check Valves for HVAC Piping."
- Q. Install unions in piping, and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

- R. Install flanges in piping, NPS 2 ½ and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- U. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 230529 "Vibration and Seismic Controls for HVAC."
- B. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
 - 1. Comply with the following requirements for maximum spacing of supports.
- C. Install the following piping attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping less than 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.

5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- D. Install hangers for steel piping, with the following maximum spacing and minimum rod sizes:
1. NPS $\frac{3}{4}$: Maximum span, 7 feet.
 2. NPS 1: Maximum span, 7 feet.
 3. NPS $1\frac{1}{2}$: Maximum span, 9 feet.
 4. NPS 2: Maximum span, 10 feet.
 5. NPS $2\frac{1}{2}$: Maximum span, 11 feet.
 6. NPS 3 and larger: Maximum span, 12 feet.
- E. Install hangers for drawn-temper copper piping, with the following maximum spacing and minimum rod sizes:
1. NPS $\frac{3}{4}$: Maximum span, 5 feet; minimum rod size, $\frac{1}{4}$ inch.
 2. NPS 1: Maximum span, 6 feet; minimum rod size, $\frac{1}{4}$ inch.
 3. NPS $1\frac{1}{4}$: Maximum span, 7 feet; minimum rod size, $\frac{3}{8}$ inch.
 4. NPS $1\frac{1}{2}$: Maximum span, 8 feet; minimum rod size, $\frac{3}{8}$ inch.
 5. NPS $2\frac{1}{2}$: Maximum span, 9 feet; minimum rod size, $\frac{3}{8}$ inch.
 6. NPS 3 and larger: Maximum span, 10 feet; minimum rod size, $\frac{3}{8}$ inch.
- F. Plastic piping hanger spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain end of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Solder joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook", using lead free solder alloy complying with ASTM B32.
- D. Brazed joints: Construct joints according to AWS's "Brazing Handbook", "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Threaded joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 2. Damaged threads: DO NOT use pipe or pipe fittings with threads that are corroded or damaged. DO NOT use pipe sections that have cracked or open welds.

3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with ball valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gauges and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gauges for HVAC Piping."

3.7 CHEMICAL TREATMENT

- A. Refer to chemical water treatment specification.

3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping in accordance with ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure is to be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
 - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
 - 1. Use ambient-temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 - 3. Isolate expansion tanks and determine that hydronic system is full of water.
 - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure is not to exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9. "Building Services Piping".
 - 5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
 - 6. Prepare written report of testing.

- 3.9 Perform the following before operating the system:
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
 7. Verify lubrication of motors and bearings

END OF SECTION 232113

SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Close-coupled, in-line centrifugal pumps.
 - 2. Separately coupled, base-mounted, end-suction centrifugal pumps.

1.2 DEFINITIONS

- A. ECM: Electronically commutated motor.
- B. EPDM: Ethylene propylene diene monomer.
- C. FKM: Fluoroelastomer polymer.
- D. HI: Hydraulic Institute.
- E. NBR: Nitrile rubber or Buna-N.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of pump.
- B. Shop Drawings: For each pump.
 - 1. Show pump layout and connections.
 - 2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
 - 3. Include diagrams for power, signal, and control wiring.
- C. See division 01 for submittal requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Pump Startup report, filled out startup checklist, and laser alignment report.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with the specified product on the drawings, provide products by one of the following:
 - 1. Grundfos.
 - 2. TACO Incorporated.
 - 3. Goulds.

- B. If product is substituted from the basis of design on the drawings and needs redesign by the design team, contractor shall compensate design team for redesign.
- C. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.
- D. Pump Construction:
 - 1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections.
 - 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
 - 3. Pump Shaft: Stainless steel.
 - 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
 - 5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
 - 6. Pump Bearings: Permanently lubricated ball bearings.
- E. Motor: Single speed and rigidly mounted to pump casing.
 - 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. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
- F. Provide and install shaft grounding ring.

2.2 SEPARATELY COUPLED, BASE MOUNTED, END SUCTION CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with the specified product on the drawings, provide products by one of the following:
 - 1. Grundfos.
 - 2. TACO Incorporated.
 - 3. Goulds.
- B. If product is substituted from the basis of design on the drawings and needs redesign by the design team, contractor shall compensate design team for redesign.
- C. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, base mounted pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally.
- D. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance.
 3. Pump Shaft: Stainless steel.
 4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
 5. Pump Bearings: Oil lubricated; bronze-journal or thrust type.
- E. Shaft Coupling: Molded-rubber insert with interlocking spider capable of absorbing vibration.
- F. Motor: Single speed and resiliently mounted to pump casing.
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. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
- G. Motor shall be NEMA Premium Efficient inverter duty motor.
- H. Provide and install shaft grounding ring.

2.3 PUMP SPECIALTY FITTINGS

- A. Suction Diffuser:
1. Angle pattern.
 2. 175-psig pressure rating, ductile-iron body and end cap, pump-inlet fitting.
 3. Bronze startup and bronze or stainless-steel permanent strainers.
 4. Bronze or stainless-steel straightening vanes.
 5. Drain plug.
 6. Factory-fabricated support.
- B. Triple-Duty Valve:
1. Angle or straight pattern.
 2. 175-psig pressure rating, ductile-iron body, pump-discharge fitting.
 3. Drain plug and bronze-fitted shutoff, balancing, and check valve features.
 4. Brass gage ports with integral check valve and orifice for flow measurement.

2.4 ELECTRONICALLY COMMUTATED MOTOR (ECM)

- A. Motors shall be:
1. Synchronous, constant torque, ECM with permanent magnet rotor. Rotor magnets to be time-stable, nontoxic ceramic magnets (Sr-Fe).
 2. Driven by a frequency converter with an integrated power factor correction filter. Conventional induction motors will not be acceptable.
 3. Each motor with an integrated variable-frequency drive, tested as one unit by manufacturer.

4. Motor speed adjustable over full range from 0 rpm to maximum scheduled speed.
5. Variable motor speed to be controlled by a 0- to 10 V-dc or 4- to 20-mA input.
6. Integrated motor protection verified by UL to protect the pump against over-/undervoltage, overtemperature of motor and/or electronics, overcurrent, locked rotor, and dry run (no-load condition).

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.
- E. Equipment Mounting:
 1. Install base-mounted pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- F. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and elastomeric hangers of size required to support weight of in-line pumps.
 1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.2 ALIGNMENT

- A. Engage a factory-authorized service representative to perform laser alignment services.
- B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
- C. Comply with pump and coupling manufacturers' written instructions.
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to pump, allow space for service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install triple-duty valve on discharge side of pumps.
- F. Install suction diffuser and shutoff valve on suction side of pumps.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
- H. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.
- I. Install check valve and gate or ball valve on each condensate pump unit discharge.
- J. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 232123

SECTION 232300 – REFRIGERANT PIPING

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410:
 - 1. Suction Lines for Air-Conditioning Applications: 200 psig
 - 2. Liquid Lines for Air-Conditioning Applications: 535 psig

1.2 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
- B. See section 013000 for submittal requirements.

1.3 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.4 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PIPING APPLICATIONS

- A. Copper and tube fittings
 - 1. Drawn-Temper Copper Tube: ASTM B 280, Type ACR, clean, dry, and capped.
 - 2. Annealed-Temper Copper Tube: ASTM B 280, Type ACR, clean, dry, and capped. Annealed copper tubing shall not be used for piping larger than 0.625 O.D.
 - 3. Wrought-Copper Fittings: ASME B16.22.
 - 4. Wrought-Copper Unions: ASME B16.22.
 - 5. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
 - 6. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

- A. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 3. Indicator: Color coded to show moisture content in ppm.
 - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.

5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

B. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina
4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
6. Maximum Pressure Loss: 2 psig
7. Working Pressure Rating: 500 psig
8. Maximum Operating Temperature: 240 deg F

2.3 REFRIGERANTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.
5. Or approved equal.

2.4 INSULATION

A. For indoor refrigerant piping, the suction piping shall be insulated with Rubatex R-180 FS or approved equal 1/2" thick closed cell foam insulation meeting all NFPA requirements for smoke density and flame spread.

B. All outdoor section of the refrigerant suction and liquid piping shall be insulated with Rubatex R-180 FS or approved equal 1/2" thick closed cell foam insulation meeting all NFPA requirements for smoke density and flame spread and covered with embossed aluminum jacket.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Suction and Liquid Lines NPS 1-1/2 for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in rigid conduit in locations where exposed to mechanical injury.
- M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- O. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."
- P. Install sleeves for piping penetrations of walls, ceilings, and floors.
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs.
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
- D. Support multifloor vertical runs at least at each floor.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Comply with ASME B31.5, Chapter VI.
 2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.6 SYSTEM CHARGING

- A. Charge system using the following procedures:
 1. Install core in filter dryers after leak test but before evacuation.
 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 4. Charge system with a new filter-dryer core in charging line.

3.7 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.

END OF SECTION 232300

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rectangular ducts and fittings.
 - 2. Sheet metal materials.
 - 3. Sealants and gaskets.
 - 4. Hangers and supports.
 - 5. Seismic-restraint devices.
 - 6. Duct Liner
- B. Related Sections:
 - 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
 - 1. See section 23 05 48 for seismic performance requirements.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2010.

1.3 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCT AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- E. Ductwork connected to dehumidification unit is to be 316 stainless-steel with stainless steel screws, stainless steel flanges and stainless-steel fittings and support.

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Aluminum sheet, ASTM B209, alloy 3003.
- D. Galvanized Steel Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- E. Aluminum Steel Tie Rods: Aluminum 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- F. Polyisocyanurate: Insulation shall be compliant with ASTM C1289, having minimum thermal resistance of 0.167 per degree F/BTUH/inch at 75-degrees F mean temperature. John Mansville AP foil insulation.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless-steel, or aluminum sheets.
- C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- D. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Pool Room: See non-metallica hangers and supports specification.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.6 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Johns Manville Linacoustic RC or comparable product by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Knauf Insulation.
 - c. Owens Corning.
 2. Duct liner shall be a minimum of 1-1/2" thick with a minimum installed R-value of R-6.
 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank,

length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
 2. Ductmate Industries, Inc.
 3. Hilti Corp.
 4. Unistrut Corporation.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service.

- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Return-Air Ducts: Seal Class C.
 - 4. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg Seal Class B.
 - 5. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 6. Conditioned Space, Return-Air Ducts: Seal Class C.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum interval of 16 feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service.

- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.7 DUCT SCHEDULE

- A. Duct Liner:
 - 1. Rectangular Supply Ducts and Fittings: Fibrous glass, 1-inch thick
 - 2. Rectangular Return Ducts and Fittings: Fibrous glass, 1-inch thick
 - 3. Rectangular Transfer Ducts and Fittings: Fibrous glass, 1-inch thick
 - 4. Rectangular Return Ducts and Fittings: Fibrous glass, 1-inch thick
 - 5. Adjust duct size to accommodate liner and give net dimensions shown on drawings.
 - 6. Ductwork connected to makeup air units shall not be internally lined.
- B. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 - 1. Ductwork connected to dehumidification unit: aluminum with marine grade paint.
- C. Supply Ducts:
 - 1. Ducts Connected to Air Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 3
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
 - 2. Ducts Connected to Makeup Air Units:
 - a. Pressure Class: Positive 3-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 3
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- D. Return Ducts:
 - 1. Ducts Connected to Air Handling Units:
 - a. Pressure Class: Positive or negative 4-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 - 2. Ducts Connected to Makeup Air Units:

- a. Pressure Class: Positive or negative 3-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 - e.
- E. Intermediate Reinforcement:
- 1. Galvanized-Steel Ducts: Galvanized steel.
- F. Elbow Configuration:
- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

- 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- G. Branch Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 - 2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Manual volume dampers.
 2. Flange connectors.
 3. Turning vanes.
 4. Fire Dampers
 5. Duct-mounted access doors.
 6. Flexible connectors.
 7. Duct accessory hardware.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement were installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Greenheck Fan Corporation.
 - b. Nailor Industries Inc.
 - c. Air Balance Inc.
 - d. Ruskin.
 - e. Vent Products Co., Inc.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Frame: Hat-shaped, 22 gauge-thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 20 gauge thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Oil-impregnated bronze.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
 - 1. Size: 0.5-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 FLANGE CONNECTORS

- 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. CL WARD & Family Inc.
 2. Ductmate Industries, Inc.
 3. Hardcast, Inc.
 4. Ward Industries, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.5 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CL WARD & Family Inc.
 2. Ductmate Industries, Inc.
 3. Duro Dyne Inc.
 4. Hardcast, Inc.
 5. METALAIRE, Inc.
 6. Ward Industries, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction: Single wall.

2.6 FIRE DAMPERS

- A. Manufacturers: Subject to compliance with the specified product on the drawings, provide products by one of the following:
 - 1. Pottorff.
 - 2. Greenheck.
 - 3. Ruskin
 - 4. Or Approved Equal
- B. Type: dynamic; rated and labeled in accordance with UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000 fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Multiple-blade type; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed galvanized sheet steel, full-length steel blade connectors. Material gauge is to be in accordance with UL listing.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Hardcast, Inc.
 - 4. Ventfabrics, Inc.
 - 5. Ward Industries, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-de, 0.028-inch-ick, galvanized sheet steel or 0.032-inch-ick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F

2.8 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness. Test holes shall be finished with a Ventlock instrument test hole assembly, Ventlock model 699.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install fire dampers in accordance with UL listing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream and downstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 6. Adjacent to and close enough to fire dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 7. At each change in direction and at maximum 50-foot spacing.
 - 8. Upstream and downstream from turning vanes.
 - 9. Upstream or downstream from duct silencers.

- 10. Control devices requiring inspection.
- 11. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Install flexible connectors to connect ducts to equipment.
- J. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- K. Connect flexible ducts to metal ducts with draw bands.
- L. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233346 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Insulated flexible ducts.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E96/E96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 INSULATED FLEXIBLE DUCTS

- A. Provide product by one of the following manufacturers:
 - 1. ATCO
 - 2. Thermaflex
 - 3. Hart & Cosley
 - 4. Or approved equal
- B. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
 - 4. Insulation R-Value: R6.

2.3 FLEXIBLE DUCT CONNECTORS

- A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect diffusers or ceiling return grilles to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- D. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.
- E. Install duct test holes where required for testing and balancing purposes.
- F. Installation:
1. Install ducts fully extended.
 2. Do not bend ducts across sharp corners.
 3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
 5. Install flexible ducts in a direct line, without sags, twists, or turns.
- G. Supporting Flexible Ducts:
1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
 2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.

END OF SECTION 233346

SECTION 233423 - HVAC POWER VENTILATORS

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. Ceiling-mounted ventilators.
 - 2. Centrifugal ventilators - roof upblast.
 - 3. Sidewall propeller fans.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, or BIM model, drawn to scale and coordinated with all building trades.
- B. Seismic Qualification Data: For fans, accessories, and components, from manufacturer.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTED VENTILATORS

- A. Basis of design product. Subject to compliance with the specified product on the drawings. Provide a product by the following:
 - 1. Greenheck
 - 2. PennBarry
 - 3. Cook
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel removable for service.
- D. Back-draft damper: Integral.

- E. Grille: Aluminum, louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
 - 1. Electronically commutated motor (ECM) with factory mounted and wire speed controller.
 - 2. Isolation: Rubber-in-shear vibration isolators.
 - 3. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.2 CENTRIFUGAL VENTILATORS - ROOF UPBLAST.

- A. Basis of design product. Subject to compliance with the specified product on the drawings. Provide a product by the following:
 - 1. Greenheck
 - 2. PennBarry
 - 3. Cook
- B. Configuration: Centrifugal roof upblast ventilator.
- C. Housing: Removable spun-aluminum dome top and outlet baffle; square, one-piece aluminum base with venturi inlet cone.
 - 1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
- D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades; spark proof construction.
- E. Direct Drive:
 - 1. Resiliency mounted to housing.
 - 2. Bearings: Permanently lubricated, permanently sealed, self-aligning, ball bearings; minimum ABMA 9 L(10) of 100,000 hours.
 - 3. Fan and motor isolated from airstream.
- F. Accessories:
 - 1. Electronically commutated motor (ECM) with factory mounted and wired motor speed controller.
 - 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 - 3. Bird Screens: Removable, 1/2-inch mesh, aluminum, or brass wire.
 - 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - 5. Spark-resistant, all-aluminum wheel construction.
 - 6. Seismic, roof curb. Coordinate pitch prior to ordering.

2.3 SIDEWALL PROPELLER FANS

- A. Basis of design product, subject to compliance with the specified product on the drawings or comparable product by one of the following manufacturers:

1. Greenheck
 2. PennBarry
 3. Or approved equal.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring, with baked-enamel finish coat applied after assembly.
- C. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- D. Fan Drive, Direct: Direct-drive motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Accessories:
1. Disconnect Switch: fused type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 2. Motorized Dampers: Parallel-blade dampers with electric actuator wired to close when fan stops.
 3. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
- F. Direct Drive:
1. Resiliency mounted to housing.
 2. Bearings: Permanently lubricated, permanently sealed, self-aligning, ball bearings; minimum ABMA 9 L(10) of 100,000 hours.
 3. Fan and motor isolated from airstream.
- G. Accessories:
1. Electronically commutated motor (ECM) with factory mounted and wired motor speed controller.
 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
 3. Bird Screens: Removable, 1/2-inch mesh, aluminum, or brass wire.
 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 5. Spark-resistant, all-aluminum wheel construction.
 6. Seismic, roof curb. Coordinate pitch prior to ordering.

2.4 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.5 SOURCE QUALITY CONTROL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

- B. AMCA Certification: Fans shall comply with AMCA 11 and bear the AMCA-Certified Ratings Seal.
- C. Fan Sound Ratings: Comply with AMCA 311, and label fans with the AMCA-Certified Ratings Seal. Sound ratings shall comply with AMCA 301. The fans shall be tested according to AMCA 300.
- D. Fan Performance Ratings: Comply with AMCA 211 and label fans with AMCA-Certified Rating Seal. The fans shall be tested for air performance - flow rate, fan pressure, power, fan efficiency, air density, speed of rotation, and fan efficiency - according to AMCA 210/ASHRAE 51.
- E. Operating Limits: Classify according to AMCA 99.
- F. UL Standards: Power ventilators shall comply with UL 705.

PART 3 - EXECUTION

3.1 INSTALLATION OF HVAC POWER VENTILATORS

- A. Install power ventilators level and plumb.
- B. Secure roof-mounted fans to roof curbs with zinc-plated hardware.
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Support suspended units from structure using threaded steel rods and spring hangers spring hangers with vertical-limit stops having a static deflection of 1 inch.
- E. Install units with clearances for service and maintenance.
- F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections.
- D. Tests and Inspections:
 1. Verify that shipping, blocking, and bracing are removed.
 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 3. Verify that there is adequate maintenance and access space.
 4. Verify that cleaning and adjusting are complete.
 5. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 6. Adjust belt tension.
 7. Adjust damper linkages for proper damper operation.
 8. Verify lubrication for bearings and other moving parts.
 9. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 10. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 11. Shut unit down and reconnect automatic temperature-control operators.
 12. Remove and replace malfunctioning units and retest as specified above.
- E. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.7 DEMONSTRATION

- A. Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233423

SECTION 233439 - HIGH-VOLUME, LOW-SPEED FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes high-volume, low-speed fans.

1.2 DEFINITIONS

- A. HVLS - High volume, low speed.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of fans that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Motor, Including Controls: three year(s) from date of Substantial Completion.
 - b. For Parts, Including Blades, and Hub: seven year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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.
- B. UL Compliance: Listed and labeled to UL 507.
- C. CSA Compliance: Listed and labeled to CSA C22.2, No. 113.
- D. Comply with NFPA 13 requirements for HVLS fans.
- E. AMCA Compliance:
 - 1. Test HVLS fans according to AMCA 230.
 - 2. Certify HVLS fan performance according to AMCA 211.

- F. Performance Data: Comply with ANSI 230 test procedure standard, based on five rating points: 20-, 40-, 60-, 80-, and 100-percent of maximum speed. Comply with AMCA 211 for publication of performance data.

2.2 CAPACITIES AND CHARACTERISTICS

- A. See drawings for capacities and characteristics:

2.3 MANUFACTURERS

- A. Basis of design product, subject to compliance with the specified product on the drawings. Provide a product by the following manufacturers:
 - 1. Big Ass Fans
 - 2. Greenheck
 - 3. Skyblade
 - 4. Or approved equal.
- B. Source Limitations: Obtain HVLS fans from single source from single manufacturer.

2.4 HIGH-VOLUME, LOW-SPEED FANS

- A. Description: Factory-assembled and -tested horizontal, non-ducted fan unit, consisting of large-diameter blade set, direct-drive electric motor, with variable-speed motor controller.
 - 1. Provide fan designed to circulate large air volume, vertically, at low velocity.
 - 2. Maximum Operating Temperature: 122 deg F
 - 3. Frame:
 - a. Material: Aluminum.
 - 1) Finish: Powdercoat.
 - 4. Diameter: 6 feet.
 - 5. Blades: Airfoil type.
 - a. Quantity: 6.
 - b. Material: Aluminum.
 - 1) Blade Finish: Anodized.
 - 6. Motor: integral to fan frame.
 - 7. Wiring and Controls Enclosure:
 - a. NEMA 250, Class 1.
 - b. Grounded.
 - 8. Mounting Bracket: Solid beam.
 - 9. Accessories:
 - a. Mounting extension tube.

PART 3 - EXECUTION

3.1 INSTALLATION OF HIGH-VOLUME LOW-SPEED FANS

- A. Examine conditions for compliance with requirements for installation tolerances and other conditions affecting HVLS fan performance, maintenance, and operations.
- B. Fan locations indicated on Drawings are approximate. Determine exact locations before roughing-in for mounting, control, and electrical connections.

- C. Install fan according to manufacturer's published instructions.
- D. Comply with NECA 1 and NFPA 70.
- E. Comply with NFPA 13 for installation of HVLS fans and maximum allowable fan diameter. Center HVLS fans between four adjacent sprinklers. Minimum vertical clearance from HVLS fan to sprinkler deflector is 3 feet.
- F. Comply with NFPA 72 and interlock HVLS fans to shut down upon receiving an alarm from fire alarm system.
- G. Equipment Mounting:
 - 1. Anchor fan to building structure with manufacturer's recommended mounting bracket for installed condition.
 - 2. Consult a licensed professional structural engineer for mounting methods and approval for mounting to the structure. Structure must be able to withstand the torque and forces generated by the fan.
 - 3. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
 - 4. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 5. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- H. Install unit to permit access for maintenance.
- I. Install parts and accessories shipped loose.
- J. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that fan is secure on mountings and supporting devices and that connections to electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
 - 3. Verify proper motor rotation direction and free fan rotation.
 - 4. Check bearing and gearbox lubrication.
 - 5. Verify proper fan rotation. Set rotation selector to blow vertically downward during heating season and vertically upward during cooling season.

3.2 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
- E. Install power wiring to field-mounted electrical devices, furnished by fan manufacturer, but not factory mounted.

3.3 CONTROL CONNECTIONS

- A. Connect control wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."
- C. Connect control interlock wiring between HVLS fan and other equipment to provide a complete and functioning system.
- D. Connect control wiring between fan unit control interface and control system to provide remote control and monitoring.
- E. Install control devices furnished by manufacturer, but not factory mounted.
- F. Install control wiring to field-mounted control devices, furnished by fan manufacturer, but not factory mounted.
- G. Protect installed units from damage caused by other work.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Fan or components will be considered defective if fan or components do not pass tests and inspections.
- C. Prepare and submit test and inspection reports.

3.5 ADJUSTING

- A. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.6 CLEANING

- A. Clean equipment externally; remove coatings applied for protection during shipping and storage, foreign material, and oily residue according to manufacturer's written instructions. Following manufacturer's cleaning procedures, and clean with manufacturer-recommended cleaning products.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain HVLS fans.

END OF SECTION 233439

SECTION 233443 VEHICLE EXHAUST EXTRACTION SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section describes vehicle exhaust extraction systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230500, Common Work Results for HVAC
- B. Section 230529, Hangers and Supports for HVAC Piping and Equipment
- C. Section 230545, Seismic Restraints for HVAC Piping and Equipment
- D. Section 230593, Testing, Adjusting, and Balancing
- E. Section 233113, Low Pressure Ductwork
- F. Section 233400, HVAC Fans

1.3 SUBMITTALS

- A. For systems, equipment, and components specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
1. Shop Drawings: Include details of construction and dimensions.
 2. Product Data: Include performance data.
- B. See specification section 013300 for additional submittal requirements.

1.4 QUALITY ASSURANCE

- A. Vehicle exhaust extraction systems supplied shall be fully compatible with the vehicles and shall be designed specifically for the use intended.
- B. All components shall be designed, constructed, and rated for the temperatures, pressures, stresses and motions required under normal operation and shall perform the required functions without need for excessive maintenance, adjustment, or parts replacement.
- C. The Contractor shall warranty the equipment and installation to be free of defects in material and workmanship and application for a period of 1-year.

PART 2 - PRODUCTS

2.1 VEHICLE EXHAUST EXTRACTION SYSTEM

- A. Manufacturers: Subject to compliance with the specified product on the drawings, provide a product by one of the following manufacturers:
 - 1. NSGV.
 - 2. Nederman.
 - 3. Or Approved Equal.

- B. Hose Reel System:
 - 1. Spring Driven Hose Reel System with on/off switch
 - 2. The flexible vehicle exhaust hose shall be 6-inch diameter, high temperature hose, suitable for use on Diesel engines, consisting of four-ply black high temperature composite impregnated fabric laminated over a spring wire helix bound with a protective yellow wear strip to allow for high visibility of hanging hose by personnel. Flame retardant to UL 94 V.O.
 - 3. Mechanical Attachment System:
 - a. Provide a fully adjustable quick-release locking clamp, protective, high temperature chloroprene rubber cover, and a high temperature rubber nozzle.
 - 4. The duct connection, with brackets, shall connect the hose to the duct system. The swivel connector shall be sealed.
 - 5. Manufacturer's contact to be connected to BMS system

- C. Exhaust Fan:
 - 1. Description:
 - a. Factory-fabricated, -assembled, -tested, and -finished, direct-driven centrifugal fan utility vent sets, consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure, fan shall be mounted to hose reel.
 - 2. Housings:
 - a. Housing Material: Reinforced steel.
 - b. Housing Coating: Powder-baked enamel.
 - c. Formed panels to make curved-scroll housings with shaped cutoff.
 - d. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - e. Discharge Arrangement: Fan scroll housing field rotatable to any of eight discharge positions. Provide fan with discharge positioned in proper direction to minimize connected duct turns.
 - 3. Wheels:
 - a. Wheel Configuration: SWSI, with hub keyed to shaft.
 - b. Wheel and Blade Materials: Steel
 - c. Forward-Curved Blades:
 - 1) Curved design.
 - 2) Heavy backplate.
 - 3) Single-thickness blades continuously welded or riveted at tip flange and backplate.
 - 4. Motor Enclosure: Open, dripproof

- D. Accessories listed in subparagraphs below are optional features. Manufacturers' catalogs list many other accessories for specialized applications.
1. Inlet and Outlet: Flanged.
 2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
 3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades, with felt edges in steel frame installed on fan discharge.
 4. Access Door: Gasketed door in scroll with latch-type handles.
 5. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
 6. Inlet Screens: Removable wire mesh.
 7. Outlet Screens: Removable wire mesh.
 8. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
 9. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
- E. MOTORS
1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install centrifugal fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
1. Support duct-mounted and other hanging centrifugal fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- E. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration-isolation and seismic-control devices.
1. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC".
- F. Install units with clearances for service and maintenance.
- G. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
- H. Install in accordance with the manufacturer's instructions.

I. Support equipment from building structures and provide seismic restrains as detailed on the drawings and in accordance with Sections 230529 and 230545.

J. Install hose reels from structure per manufacturer's instructions.

3.2 DUCTWORK

A. Install ducts adjacent to fans to allow service and maintenance.

B. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. See electrical drawings and specifications for identification requirements.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.5 TESTING

A. Check out, start up, and test systems, equipment, and components specified herein.

B. Have a factory representative do a point-to-point commissioning of the exhaust system prior to turnover to owner.

3.6 TRAINING

A. Engage a factory authorized representative to train user on system.

END OF SECTION 233443

SECTION 233600 – AIR TERMINAL UNITS

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Shutoff, single-duct air terminal units.
 - 2. Casing liner.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 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.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 – PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE/IES 90.1, "Section 6 - Heating, Ventilating, and Air Conditioning."

2.2 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Enviro-tec; by Johnson Controls, Inc.
 - 2. Krueger
 - 3. Price Industries
 - 4. Titus
- B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

- C. Casing: Minimum 22-gauge galvanized steel thick galvanized steel, single wall.
 - 1. Casing Liner: Comply with requirements in "Casing Liner".
 - 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 - 3. Air Outlet: S-slip and drive connections, size matching inlet size.
 - 4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
 - 5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
 - 1. Maximum Damper Leakage: AHRI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
 - 2. Damper Position: Normally closed.
- E. Primary Airflow Sensor:
 - 1. For inlet diameters 6" or greater, the differential pressure airflow sensor shall traverse the duct along two perpendicular diameters. Cylindrically shaped inlets shall utilize the equal cross sectional area or log-linear traverse method. Single axis sensor shall not be acceptable for duct diameters 6" or larger. A minimum of 12 total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. A sensor that delivers the differential pressure signal from one end of the sensor is not acceptable. The sensor shall output an amplified differential pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube. The sensor shall develop a differential pressure of 0.03" w.g. at an air velocity of < 450 FPM. Documentation shall be submitted which substantiates this requirement. Balancing taps and airflow calibration charts shall be provided for field airflow measurements.
- F. Attenuator Section: 22-gauge galvanized steel sheet.
 - 1. Attenuator Section Liner: Comply duct insulation or metal duct specification requirements.
 - 2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- G. Hydronic Heating Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include auto air vent and drain valve.
- H. Control devices shall be compatible with temperature controls system specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2.3 CASING LINER

- A. Casing Liner: Flexible elastomeric duct liner fabricated of preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 - 1. Minimum Thickness: 1/2 inch.

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. Adhesive VOC Content: 50 g/L or less.
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test assembled air terminal units according to AHRI 880.
 1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.2 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7. Comply with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on air terminal units that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

3.3 ELECTRIC POWER

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- C. Where installing piping adjacent to air terminal unit, allow space for service and maintenance.
- D. Hot-Water Piping: Comply with requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties," and connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
- E. Comply with requirements in Section 233113 "Metal Ducts" for connecting ducts to air terminal units.
- F. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."
- G. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
 - 2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- B. Air terminal unit will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Rectangular and square ceiling diffusers.
 2. Return and Exhaust Grilles
 3. Duct mounted supply and exhaust grilles.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. See section 013000 for submittal requirements.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Krueger.
 - b. Price Industries.
 - c. Titus.
 2. Material: Aluminum.
 3. Finish: Baked enamel, white.

2.2 RETURN AND EXHAUST GRILLES

- A. Rectangular and Square return and exhaust grilles:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Krueger.
 - b. Price Industries.
 - c. Titus.
 2. Material: Aluminum.
 3. Finish: Baked enamel, white.

2.3 DUCT MOUNTED SUPPLY AND EXHAUST GRILLES

- A. Rectangular and Square return and exhaust grilles:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Air Concepts.
 - b. Krueger.
 - c. Price Industries.
 - d. Titus.
2. Material: Aluminum.
3. Finish: Baked enamel, white.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 235100 – BREECHINGS, CHIMNEYS AND STACKS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes the following:
 - 1. Polypropylene flue and combustion air piping (PP).
 - 2. Listed B-Vent.
 - 3. Dry duct and prefabricated dryer box.
 - 4. Listed double wall vents.
- B. Shop drawing: For vents, breaching, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.

PART 2 - PRODUCTS

2.1 POLYPROPYLENE VENT PIPING

- A. Manufacturers:
 - 1. DuraVent
 - 2. Centrotherm
 - 3. Or approved equal
- B. Polypropylene pipe for use with ANSI Category II and IV gas burning appliances.
 - 1. Fittings: Polypropylene compatible with supplied piping.
 - 2. Joints: Gaskets with locking band.

2.2 LISTED TYPE B VENTS

- A. Provide a product by the following manufacturer that meets the requirements in this specification section:
 - 1. Metal-Fab
 - 2. DuraVent
 - 3. Or approved equal
- B. Description: Double wall metal vents tested according to UL441 and rated for 480 deg F continuously for Type B with neutral or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least ¼- inch airspace.
- D. Inner Shell: Aluminum Alloy.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designed as vent-pipe straight sections; all listed for same assembly.
 - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

2. Termination: Round Chimney top designed to exclude minimum 98 percent of rainfall.
3. Termination: Exit cone with drain section incorporated into riser.
4. Termination: Anti-backdraft.

2.3 DRYER VENTING

- A. Prefabricated Dryer Box
 1. Manufacturers:
 - a. The Drybox
 - b. Everbilt
 - c. Or approved equal
 2. To be constructed of 22-gauge aluminum (minimum) with nailing flange.
 3. Provide and install manufacturer's discharge outlet with a field fabricated 14" curb.
 4. Contractor to coordinate pitch prior to fabrication.
- B. Ducting
 1. Minimum 28-gauge aluminum ducting.
 2. All transitions shall be made with Dryer-ell, zero run penalty elbows (or approved equal).

2.4 LISTED DOUBLE WALL GAS VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Heat-Fab, Inc.
 2. Metal-Fab, Inc.
 3. Jeremiah's
 4. Or approved equal
- B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211. The vent shall be of the double-wall, factory type for use on condensing appliances or pressurized venting systems serving Category II, III or IV appliances or as specified by the equipment manufacturer.
- C. Maximum temperature shall not exceed 550°F.
- D. Vent shall be listed for an internal static pressure of 6" w.g. and tested to 15" w.g.
- E. Vent shall be constructed with an inner and outer wall, with a 1" annular insulating air space.
- F. The inner wall (vent) shall be constructed of AL29-4C, Type 444, or 316L superferritic stainless steel, .015 thickness for 3" – 12" diameters and .024 thickness for 14"-24" diameters. The outer wall (casing) shall be constructed of 304 stainless steel, .018 thickness for 3"-12" diameters and .24 thickness for 14"-24" diameters. Inner and outer walls shall be connected by means of spacer clips that maintain concentricity of the annular space and allow unobstructed differential thermal expansion of the inner and outer wall.

- G. All supports, roof or wall penetrations, terminations, appliance connectors and drain fittings, required to install the vent system shall be included.
- H. Roof penetration pieces shall be UL listed and provide by the vent manufacture. Roof curbs shall be required on roofs greater than 12:12 pitch.
- I. All inner vent connections shall be secured by means of profiled connector bands with gear clamp tighteners. Joints shall be sealed with P077 Sealant. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
- J. Vent shall terminate in accordance with installation instructions and local codes.
- K. Construction: Inner shall and outer jacket separated by at least a 1-inch airspace.
- L. Inner Shell: UL 1738 compliant stainless steel.
- M. Outer Jacket: 304 Stainless-steel.
- N. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spaced, and fasteners; fabricated from similar materials and designed as vent-pip straight sections; all listed for same assembly.
 - 1. Termination: Stack cap designed to exclude minimum 90 percent of rainfall.

PART 3 - EXECUTION

3.1 POLYPROPYLENE SCHEDULE

- A. Water Heater flue and combustion air piping and fittings shall be the following:
 - 1. Polypropylene (PP). Provide with polypropylene manufacturer's concentric termination outlet.

3.2 LISTED B-VENT SCHEDULE

- A. Infrared Heater flue and fittings shall be the following:
 - 1. Double Wall Listed B-Vent

3.3 DOUBLE WALL GAS VENT SCHEDULE

- A. Boiler flue and fittings shall be the following:
 - 1. Double Wall, UL 1738, stainless-steel flue.

3.4 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearance from combustibles and minimum termination heights according to product listing or NFPA 21, whichever is most stringent.
- B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Lap joints in direction of flow.
- F. After completing system installation, including outlet fitting and devices, inspect exposed finish., Remove burrs, dirt, and construction debris and repair damaged finishes.
- G. Clean breeching internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- H. Provide temporary closures at ends of breechings, chimneys, and stack that are not completed or connected to equipment.

3.5 INSTALLATION OF POLYPROPYLENE FLUE AND COMBUSTION AIR PIPING

- A. Install in accordance with NFPA 54 and manufacturer's installation instructions.
- B. Maintain all listed minimum clearances. Assemble pipe and accessories for complete installation.
- C. Provide gaskets and locking rings on all joints.
- D. Slope piping as required for each appliance and in accordance with installation instructions.
- E. Provide all required appliance adapter clamps and any required adapter fittings.
- F. Support piping at each offset and as required by pipe manufacturer.
- G. Provide Polypropylene Concentric Vent Termination Kit for each appliance.
- H. Use black UV protected components on all venting installed on the exterior of the building.

3.6 INSTALLATION OF DRYER DUCT

- A. Dryer duct shall be installed with no screws in the air stream of ductwork per NFPA.
- B. No connection seams shall be in wall.

END OF SECTION 235100

SECTION 235216 - CONDENSING BOILERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Packaged, factory-fabricated and assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for generating and heating hot water.

1.2 SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- C. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, and attachments to other work details.
 - 1. Wiring diagrams: Power, signal, and control wiring.
- D. Operation and maintenance data.
- E. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

- A. 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.
- B. ASME compliance: Fabricate and label boilers to comply with ASME Boiler and Pressured vessel code.
- C. ASHRAE/IESNA 90.1 compliance: Boilers shall have minimum efficiency according to “Gas and Oil-Fired Boilers- Minimum Efficiency Requirements”.
- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, “Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers”.
- E. UL compliance: Test boilers form compliance with UL 795, “Commercial-Industrial Gas Heating Equipment”.
- F. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- G. Boiler installation shall meet the latest edition of the ASME CSD-1 code Nevada State Boiler code.

1.4 WARRANTY

- A. Special warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Water-Tube Condensing Boilers:
 - a. Heat Exchanger damaged by thermal stress and corrosion: non-prorated for a minimum of 20 from the date of substantial completion.
 - b. Parts and labor on gas train, boiler for 1 year from date of substantial completion.

PART 2 - PRODUCTS

2.1 FIRE-TUBE CONDENSING BOILERS

- A. Basis of design product: Subject to compliance with requirements, provide the product indicated on the drawings or a comparable product by one of the following:
 - a. Lochinvar.
 - b. Cleaver Brooks.
 - c. Fulton.
 - d. Or pre-approved equal.
- B. Description: Factory-fabricated, assembled, and tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water-heating service only.
- C. The boiler's condensing capability shall allow the boiler to be operated without the use of a 3-way valve for the boiler supply water temperature reset. No minimum boiler return water temperature or secondary pump or minimum flow rate shall be required to protect the boiler against thermal shock or for minimum temperature water.
- D. Heat Exchanger: The heat exchanger shall bear the ASME "H" stamp for 160 psi working pressure and shall be a National Board listed. The heat exchanger shall be constructed of a fully welded 3161L stainless steel and of fire tube design. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.
- E. Combustion Chamber: The combustion chamber shall be constructed of cast-iron. It shall be a down-fired design utilizing light weight refractory around the burner housing or stainless-steel, sealed.
- F. Burner: Natural gas, negative-pressure gas valve.
- G. Blower: Centrifugal fan to operate during each burner-firing sequence and to prepurge and postpurge the combustion chamber.
 - 1. Motors sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- H. Gas Train: CCSD-1 compliant combination gas valve with manual shutoff and pressure regulator.

- I. Ignition: Direct-spark ignition.
- J. Integral Circulator: Stainless-steel body and stainless-steel impeller sized for minimum flow required in heat exchanger.
- K. Casing:
 - 1. Jacket: Sheet metal, with snap-in or interlocking closures.
 - 2. Control Compartment Enclosures: NEMA 250, Type 1A.
 - 3. Finish: Textured epoxy protective finish.
 - 4. Insulation: Minimum 1 inch-thick, mineral-fiber insulation surrounding the heat exchanger.
 - 5. Combustion-Air Connections: Inlet and vent duct collars.
 - 6. Mounting base to secure boiler.
- L. Capacities and Characteristics:
 - 1. See drawings for capacities and characteristics.
- M. Options:
 - 1. Manufacturers provided and installed boiler drain valve.
 - 2. Manufacturers condensate neutralization kit.
 - 3. Manufacturers primary boiler pump relay mounted and wired for single power connection.
 - 4. Flow switch or low water cutoff switch with manual reset.
 - 5. Digital display with alarm and status LEDs.
 - 6. Sequential and diagnostic control panel.
 - 7. ASME rated pressure relief valve.
 - 8. 0-10Vdc building management input system.
 - 9. Contacts on any failure.
 - 10. Modulating burner with 5:1 turn down ratio.
 - 11. Spark ignition.
 - 12. Factory system header sensor with immersion well.
 - 13. Vent material shall be double wall UL 1738 compliant flue.
 - 14. Factory appliance regulator; regulator to be vented outside.
 - 15. Manufacturers RM7800 ignition system display module, one per boiler.
 - 16. Factory training and authorized startup.

2.2 TRIM

- A. Include devices sized to comply with ANSI B31.9, "Building Services Piping".
- B. Aquastat Controllers: Operating, firing rate, and high limit.
- C. Safety Relief Valve: ASME rated.
- D. Pressure and Temperature Gauge: Minimum 3-1/2-inch diameter, combination water-pressure and temperature gauge. Gauges shall have operating-pressure and temperature ranges, so normal operating range is about 50 percent of full range.
- E. Boiler air vent: Automatic.
- F. Drain Valve: Minimum NPS 3/4 hose-end gate valve.

2.3 CONTROLS

- A. The control system shall consist of a master panel and system intelligence device that is to be located within the mechanical room. The master panel shall be capable of controlling inputs and outputs of a maximum of 16 boilers. Control system is to be wired system, wireless system will not be accepted.
- B. Boiler operating control shall include the following devices and features:
 - 1. Supply water temperature sensor.
 - 2. Return water temperature sensor.
 - 3. Outdoor temperature sensor.
 - 4. Flow meter.
 - 5. Set-point adjust: Set points shall be adjustable.
 - 6. BacNet communication to Alerton Building Management System.
 - 7. Sequence of operation:
 - a. Electric, factory-fabricated, and field-installed panel control burner-firing rate to reset supply water temperature inversely with outside air temperature.
 - b. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
- C. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - 1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
 - 2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
 - 3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
 - 4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- D. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - 1. Hardwired Points:
 - a. Monitoring: On/off status, common trouble alarm.
 - b. Control: On/off operation, hot-water-supply temperature set-point adjustment.
 - 2. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, and locally at boiler control panel shall be available through building automation system.

2.4 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are shown in Division 26 Sections.

- B. Single-Point Field Power Connection: Factory-installed and wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - 1. House in NEMA 250, Type 1 enclosure.
 - 2. Wiring shall be numbered and color coded to match wiring diagram.
 - 3. Install factory wiring outside of an enclosure in a metal raceway.
 - 4. Field power interface shall be to fused disconnect switch.
 - 5. Provide branch power circuit to each motor and to controls with a disconnect switch.
 - 6. Provide each motor with overcurrent protection.
- C. Pump relay: Boiler shall have a relay to energize boiler pump.
- D. Boiler shall not use a transformer to step-down main voltage.

2.5 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, in accordance with ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 BOILER INSTALLATION

- A. Install boilers level on concrete base. Concrete base is specified in Division 23 Section "Common Work Results for HVAC" and concrete materials and installation requirements are specified in Division 03.
- A. Install gas-fired boilers according to NFPA 54.
- B. Assemble and install boiler trim.
- C. Install electrical devices furnished with boiler but not specified to be factory mounted.
- D. Install control wiring to field-mounted electrical devices.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 23 Section "Common Work Results for HVAC".
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tapplings with shutoff valve, and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Boiler Venting:
 - 1. Install flue-venting kit and combustion-air intake.
 - 2. Connect full size to boiler connections.
- I. Ground equipment according to electrical specifications.
- J. Connect wiring according to electrical specifications.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturers Field Service: Engage a factory- authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform installation and startup checks in accordance with manufacturer's written instructions.
 - 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.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high and low-limit safety set points of fuel supply, water level, and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 235216

SECTION 235523.13 - LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes low-intensity, gas-fired, draft-induced radiant heaters.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: All warranty periods listed below are from date of Substantial Completion.
 - a. Burner Assembly: Three years.
 - b. Combustion and Emitter Tubes: Three years.
 - c. Heater Controls: The years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. CSA certified, with CSA Seal and certification number clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.
- B. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.
- C. 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.

2.2 FORCED-DRAFT HEATERS

- A. Basis of design product, subject to compliance with the specified product on the drawings. Provide a product by one of the following manufacturers.
- B. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.
- C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- D. Burner Assembly:
 - 1. Combustion-Air Inlet: Ducted vertical to outdoors through roof with vent caps.
 - 2. Ignition System: Direct spark 24/25-V ac with flame rod sensing capabilities and self-diagnostic control module.
- E. Combustion Chamber: 4-inch-diameter, 12-gage, stainless steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.
- F. Emitter Tube: 4-inch-diameter, 16-gage, stainless-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.
- G. Reflector: Polished stainless steel, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Reflectors or entire heater shall accommodate rotational adjustment from horizontal to a minimum 30-degree tilt from vertical.
- H. Capacities and Characteristics:
 - 1. See drawings for capacities and characteristics.

2.3 CONTROLS AND SAFETIES

- A. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve that contains pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
- B. Failure Safeguards: 100 percent shutoff of gas flow in the event of flame or power failure.
- C. Prepurge of 30 seconds of air control system prior to burner ignition.
- D. Safety lockout of burner after three consecutive ignition failures.
- E. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.
- F. Control Panel Interlock: Stops burner if panel is open.
- G. Indicator Lights: "burner-on" indicator lights.

- H. Thermostat: Single-stage, wall-mounted type with 50 to 90 deg F operating range and fan on switch.
 - 1. Control Transformer: Integrally mounted.
- I. Thermostat: Two-stage, wall-mounted type with 50 to 90 deg F operating range and fan on switch.
 - 1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.
- B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments.
 - 1. Restrain the unit to resist seismic acceleration. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- C. Maintain manufacturers' recommended clearances for combustibles.
- D. Gas Piping: Comply with Section 221123 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
 - 1. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54.
- E. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.
- F. Vent Connections: Comply with Section 233113 "Metal Ducts" and with Section 235123 "Gas Vents."
- G. Electrical Connections: Comply with applicable requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Verify bearing lubrication.
 - 3. Verify proper motor rotation.
 - 4. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.

- b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
 - B. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.
 - C. Prepare test and inspection reports.
- 3.3 ADJUSTING
- A. Adjust initial-temperature set points.
 - B. Adjust burner and other unit components for optimum heating performance and efficiency.

END OF SECTION 235523.13

SECTION 235700 - HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes gasketed-plate heat exchangers.

1.2 INFORMATIONAL SUBMITTALS

- A. See Section 013300 – Submittal requirements.
- B. Sample Warranty: For manufacturer's warranty.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of heat exchangers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Periods: From date of Substantial Completion.
 - a. Plate Heat Exchangers:
 - 1) Gasketed-Plate Type; One year(s).

PART 2 - PRODUCTS

2.1 GASKETED-PLATE HEAT EXCHANGERS

- A. Basis of design product subject to compliance with the specified product by one of the following manufacturers.
 - 1. Sondex
 - 2. Danfoss
 - 3. Alfa Laval
 - 4. Or an approved equal.
- B. Configuration: Freestanding assembly, consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets. Floor-mounted heat exchangers must have integral legs with mounting feet.
- C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.
- D. Frame:
 - 1. Capacity to accommodate 20 percent additional plates.
 - 2. Painted carbon steel with provisions for anchoring to support.

- E. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.
 - 1. Fabricate attachment of heat-exchanger support bars and guide bars with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger support bars and guide bars are anchored to building structure.
- F. End-Plate Material: Painted carbon steel.
- G. Tie Rods and Nuts: Steel or stainless steel.
- H. Plate Material: 0.024 inch thick before stamping; Type 304 stainless steel.
- I. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tappings to shell before testing and labeling.
 - 1. NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2. NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless-steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
- J. Enclose plates in solid aluminum removable shroud.
- K. Capacities and Characteristics:
 - 1. See drawings for capacities and characteristics.

2.2 ACCESSORIES

- A. Pressure-Relief Valves: Steel, ASME rated and stamped.
 - 1. Pressure-relief valve setting: 50 psig.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect heat exchangers in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1. Affix ASME International label.
- B. Hydrostatically test heat exchangers to minimum of one and one-half times pressure rating before shipment.
- C. Heat exchangers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF HEAT EXCHANGER, GENERAL

- A. Equipment Mounting:
 - 1. Install floor-mounted heat exchangers on cast-in-place concrete equipment bases. Install all heat exchangers level and plumb in accordance with manufacturer's recommendations. Install floor-mounted and wall-hung steam

heat exchangers at sufficient height, using sufficient length supports, to achieve required steam and condensate pipe pitch. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

3.2 INSTALLATION OF GASKETED-PLATE HEAT EXCHANGER

- A. Install floor-mounted gasketed-plate heat exchangers on cast-in-place concrete equipment base, and fasten legs to base.
- B. Install metal shroud over installed gasketed-plate heat exchanger in accordance with manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Maintain manufacturer's recommended clearances for tube removal, service, and maintenance.
- C. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.
- D. Install shutoff valves at heat-exchanger inlet and outlet connections.
- E. Install pressure-relief valves on heat-exchanger shells where a connection has been provided on shell. When no shell pressure-relief valve connection has been provided, install pressure-relief valve on shell outlet piping before any isolation valves.
- F. Install pressure-relief valves on heat-exchanger tube outlet piping before any isolation valves.
- G. Pipe pressure-relief valves, full size of valve connection, to floor drain.
- H. Install vacuum breaker at heat-exchanger steam inlet connection.
- I. Install hose end valve to drain shell.
- J. Install thermometer on each heat-exchanger fluid inlet and outlet piping. Comply with requirements for thermometers specified in Section 230519 "Meters and Gages for HVAC Piping."
- K. Install pressure gauges on each heat-exchanger fluid inlet and outlet piping. Comply with requirements for pressure gauges specified in Section 230519 "Meters and Gauges for HVAC Piping."

3.4 CLEANING

- A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.
- B. Isolate heat exchangers from piping before flushing piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blind flanges in flanged joints to isolate equipment.
- C. Flush heat-exchanger piping systems with clean water; then remove and clean or replace strainer screens before reopening flow to heat exchangers.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency, Owner: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency, Contractor: Engage a qualified testing agency to perform tests and inspections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative:
- D. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Heat exchanger will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers.

END OF SECTION 235700

SECTION 236200 - PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Compressor and condenser units, air cooled, 6 to 120 tons.

1.2 ACTION SUBMITTALS

- A. Product Data: For each compressor and condenser unit.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Filled out manufacturer's startup checklist to be included in the Operation and Maintenance manual.

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-In-Place Concrete."
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."
- C. Coordinate location of piping and electrical rough-ins.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
 - 2. Warranty Period (Compressor Only): Five years from date of Substantial Completion.

PART 2 - PRODUCTS

- A. Fabricate and label refrigeration system in accordance with ASHRAE 15 and ASHRAE 34.

- B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."
- C. 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.

2.2 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 6 TO 120 TONS

- A. Basis-of-Design product, subject to compliance with the specified product on the drawings, provide a product by one of the following manufacturers:
 - 1. Samsung
 - 2. Trane
 - 3. Carrier
 - 4. Daikin
 - 5. Or approved equal
- B. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.
- C. Compressor:
 - 1. Hermetic or semihermetic rotary-screw compressor designed for service with crankcase sight glass, crankcase heater, and back seating service access valves on suction and discharge ports.
 - a. Capacity Control: Variable-frequency controller.
- D. Refrigerant: R-410A.
- E. Condenser Coil: aluminum microchannel-tube, aluminum-fin coil, including subcooling circuit and back seating liquid-line service access valve.
 - 1. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
- F. Condenser Fans: Propeller-type vertical discharge; either directly or belt driven. Include the following:
 - 1. Permanently lubricated, ball-bearing motors.
 - 2. Separate motor for each fan.
 - 3. Dynamically and statically balanced fan assemblies.
- G. Operating and safety controls include the following:
 - 1. Manual-reset, high-pressure cutout switches.
 - 2. Automatic-reset, low-pressure cutout switches.
 - 3. Low-oil-pressure cutout switch.
 - 4. Compressor-winding thermostat cutout switch.
 - 5. Three-leg, compressor-overload protection.
 - 6. Control transformer.
 - 7. Magnetic contactors for compressor and condenser fan motors.
 - 8. Timer to prevent excessive compressor cycling.
- H. Accessories:
 - 1. Low-Ambient Controller:

- a. Controls condenser fan speed to permit operation down to minus 20 deg F with time-delay relay to bypass low-pressure switch.
2. Gauge Panel: Package with refrigerant circuit suction and discharge gauges.
3. Hot-gas bypass kit.
4. Part-winding-start timing relay, circuit breakers, and contactors.
5. Reversing valve.
6. Low-noise fans.
7. Manufacturer's Electronic Expansion Valves installed at the air handler coil
- I. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:
 1. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
 2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
 3. Gasketed control panel door.
 4. Condenser coil hail guard.
- J. Capacities and Characteristics:
 1. See drawings for capacities and characteristics.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 SOURCE QUALITY CONTROL

- A. Performance Ratings: Certify capacity performance ratings of compressor and condenser units in accordance with AHRI 340/360.

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 compressor and condenser units.
- B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- C. Examine walls, floors, and roofs for suitable conditions where compressor and condenser units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install units level and plumb, firmly anchored in locations indicated.
- B. Install roof-mounting units on equipment supports specified in Section 077200 "Roof Accessories."
- C. Equipment Mounting:
 - 1. Comply with requirements for seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- D. Maintain manufacturer's recommended clearances for service and maintenance.
- E. Loose Components: Install piping specialties, electrical components, devices, and accessories that are not factory mounted.

3.3 PIPING CONNECTIONS

- A. Where installing piping adjacent to equipment, allow space for service and maintenance.
- B. Connect refrigerant piping to air-cooled compressor and condenser units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Section 232300 "Refrigerant Piping."

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.6 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions and perform the following:
 - a. Inspect for physical damage to unit casing.
 - b. Verify that access doors move freely and are weathertight.

- c. Clean units and inspect for construction debris.
- d. Verify that all bolts and screws are tight.
- e. Adjust vibration isolation and flexible connections.
- f. Verify that controls are connected and operational.

- B. Start unit in accordance with manufacturer's written instructions and complete manufacturer's startup checklist.
- C. Measure and record airflow and air temperature rise over coils.
- D. Verify operation of condenser capacity control device.
- E. Verify that vibration isolation and flexible connections prevent vibration transmission to structure.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections.
 - 1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
 - 2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. Verify manufacturer's required airflow over coils.
- B. Compressor and condenser units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain compressor and condenser units.

END OF SECTION 236200

SECTION 237313.13 - INDOOR, BASIC AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes factory-assembled, indoor air-handling units with limited features, including the following components and accessories:
 - 1. Casings.
 - 2. Fans, drives, and motors.
 - 3. Coils.
 - 4. Air filtration.
 - 5. Dampers.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. Product Data: For each air-handling unit.

1.3 INFORMATIONAL SUBMITTALS

- A. Startup service reports.
- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of indoor, basic, air-handling units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Manufacturer's standard, but not less than one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- 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.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

2.2 CAPACITIES AND CHARACTERISTICS

- A. See drawings for capacities and characteristics.

2.3 MANUFACTURERS

- A. Basis of design product, subject to compliance with the specified product on the drawings, provide a product by the following manufacturers:
 - 1. Pace.
 - 2. Scotts Springfield.
 - 3. UMP.
 - 4. Temtrol.
 - 5. Or approved equal.

2.4 UNIT CASINGS

- A. General Fabrication Requirements for Casings;
 - 1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
 - 2. Joints: Sheet metal screws or pop rivets.
 - 3. Sealing: Seal all joints with water-resistant sealant. Hermetically seal at each corner and around entire perimeter.
- B. Double-Wall Construction:
 - 1. Outside Casing Wall: Galvanized steel, minimum 18 gauge thick, with manufacturer's standard finish.
 - 2. Inside Casing Wall: G90 galvanized steel, solid, minimum 18 thick.
 - 3. Floor Plate: G90 galvanized steel, minimum 18 gauge thick.
 - 4. Casing Insulation:
 - a. Materials: Glass-fiber blanket, Type I or Type II ASTM C1071.
 - b. Insulation Thickness: 1 inch.
 - c. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roofs of air-handling unit.
- C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
- D. Static-Pressure Classifications:
 - 1. For Unit Sections Upstream of Fans: Minus 3-inch wg.
 - 2. For Unit Sections Downstream and Including Fans: 4-inch wg.
- E. Panels and Doors:
 - 1. Doors:
 - a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - b. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside.

Arrange doors to be opened against airflow. Provide safety latch retainers on doors so that doors do not open uncontrollably.

- c. Gasket: Neoprene, applied around entire perimeters of frame.
Size: Large enough to allow for unobstructed access for inspection and maintenance of air-handling unit's internal components. At least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.

2.5 CONDENSATE DRAIN PANS:

- 1. Location: Each type pf cooling coil.
- 2. Construction:
 - a. Single-wall, stainless steel sheet.
- 3. Drain Connection:
 - a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both end of pan.
 - b. Minimum connection size: NPS 1.

2.6 FAN, DRIVE, AND MOTOR SECTION

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- B. Fans: Centrifugal, galvanized steel; mounted on solid-steel shaft.
 - 1. Shafts: With field-adjustable alignment.
 - a. Turned, ground, and polished hot-rolled steel with keyway.
 - 2. Shaft Bearings:
 - a. Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.
 - 3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
 - a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
 - 4. Housings, Plenum Fans: Steel frame and panel; fabricated without fan scroll and volute housing. Provide inlet screens for Type SWSI fans.
 - 5. Forward-Curved, Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; aluminum hub swaged to backplate and fastened to shaft with setscrews.
 - 6. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
 - 7. Shaft Lubrication Lines: Extended to a location outside the casing.
- C. Motors:
 - 1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 2. Enclosure Type: Open, dripproof.
- D. Variable-Frequency Motor Controller: Serving all fans combined in fan array.
 - 1. Manufactured Units: Pulse-width modulated; variable torque inverter-duty motors.

2. Output Rating: Three phase; 10 to [0 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

2.7 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with AHRI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.
4. Hot-Water Coils: Continuous circuit.
 - a. Piping Connections: Threaded same end of coil.
 - b. Tube Material: Copper.
 - c. Fin Type: Plate.
 - d. Fin Material: Aluminum.
 - e. Fin and Tube Joint: Mechanical bond].
 - f. Headers:
 - 1) Cast iron with cleaning plugs and drain and air vent tappings extended to exterior of unit.
 - 2) Seamless copper tube with brazed joints, prime coated.
 - 3) Fabricated steel, with brazed joints, prime coated.
 - 4) Provide insulated cover to conceal exposed outside casings of headers.
 - g. Frames: Channel frame, minimum 0.052-inch-thick galvanized steel.
 - h. Coil Working-Pressure Ratings: 200 psig 325 deg F.

B. Refrigerant Coils:

1. Refrigeration Coil: Continuous circuit.
 - a. Tubes: Copper.
 - b. Fins:
 - 1) Material: Aluminum.
 - c. Fin and Tube Joints: Mechanical bond.
 - d. Headers: Seamless-copper headers with brazed connections
 - e. Frames: Galvanized steel.
 - f. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
 - 1) Working Pressure: Minimum 350 psig.

2.8 AIR FILTRATION SECTION

A. Panel Filters:

1. Description: Pleated factory-fabricated, self-supported disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic, or cotton fibers coated with nonflammable adhesive and antimicrobial coating.

B. Side-Access Filter Mounting Frames:

1. Particulate Air Filter Frames: Match inner casing and outer casing material, and insulation thickness. Galvanized steel track.
 - a. Sealing: Incorporate positive-sealing device to ensure seal between gasketed material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

2.9 DAMPERS

- A. Dampers: Comply with requirements in Section 230923.12 "Control Dampers."
- B. Damper Operators: Comply with requirements in Section 230923.12 "Control Dampers."

2.10 MATERIALS

- A. Steel:
 1. ASTM A36/A36M for carbon structural steel.
 2. ASTM A568/A568M for steel sheet.
- B. Stainless Steel:
 1. Manufacturer's standard grade for casing.
 2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.
- C. Galvanized Steel: ASTM A653/A653M.
- D. Aluminum: ASTM B209.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- B. Suspended Units: Suspend and brace units from structural-steel support frame using threaded steel rods and spring hangers. Coordinate sizes and locations of structural-steel support members with actual equipment provided. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- E. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.2 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to air-handling unit, allow for service and maintenance.
- C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.
- D. Connect condensate drain pans using NPS 1-1/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Hot-Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- F. Refrigerant Piping: Comply with applicable requirements in Section 232300 "Refrigerant Piping." Install shutoff valve and union or flange at each supply and return connection.

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.

3.5 STARTUP SERVICE

- A. Perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that shipping, blocking, and bracing are removed.

3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
7. Comb coil fins for parallel orientation.
8. Verify that proper thermal-overload protection is installed for electric coils.
9. Install new, clean filters.
10. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.
- C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 CLEANING

- A. After completing system installation and testing, adjusting, and balancing of air-handling unit and air-distribution systems, and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313.13

SECTION 237423.16 - PACKAGED, INDIRECT-FIRED, OUTDOOR MAKEUP-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes outdoor, indirect, gas-fired, heating-only, makeup air units, including the following components:
 - 1. Casings.
 - 2. Outdoor-air intake hood.
 - 3. Roof curbs.
 - 4. Fans, drives, and motors.
 - 5. Dampers.
 - 6. Indirect, gas-fired burners.
 - 7. Evaporative Cooler.
 - 8. Controls.

1.2 ACTION SUBMITTALS

- A. Product Data: For each outdoor, indirect, gas-fired, heating-only, makeup air unit.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For indirect, gas-fired, makeup air units to include in emergency, operation, and maintenance manuals.
- B. Filled out manufacturer's startup checklist is to be included in the Operation and Maintenance Manual.

1.5 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of indirect, gas-fired heating and ventilating units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Entire Unit: Manufacturer's standard, but not less than **[one]** **<Insert number>** year(s) from date of Substantial Completion.
 - 2. Warranty Period for Heat Exchangers: Not less than **[five]** **<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of units and components.

2.2 CAPACITIES AND CHARACTERISTICS

- A. See drawings for capacities and characteristics.

2.3 MANUFACTURERS

- A. Basis-of-Design Product, subject to compliance with the specified product on the drawings. Provide a product by one of the following manufacturers:
 - 1. Greenheck
 - 2. Cook
 - 3. Applied Air
 - 4. Or Approved Equal

2.4 UNIT CASINGS

- A. General Fabrication Requirements for Casings:
 - 1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
 - 2. Casing Joints: Sheet metal screws or pop rivets, factory sealed with water-resistant sealant.
 - 3. Makeup Air Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.
- B. Configuration: Horizontal unit with bottom discharge for roof-mounting installation.
- C. Double-Wall Construction:
 - 1. Outside Casing Wall: Galvanized steel minimum 18 gauge thick, with manufacturer's standard finish.
 - 2. Inside Casing Wall:
 - a. Inside Casing, Burner Section: Galvanized steel, solid, minimum 14-gauge thick steel.
 - b. Inside Casing, All Other Sections: Galvanized steel.
 - 3. Floor Plate: Galvanized steel, minimum 18 gauge thick.
 - 4. Casing Insulation:
 - a. Materials: Glass-fiber blanket or board insulation, Type I or Type II ASTM C1071.
 - b. Insulation Thickness: 1 inch.
 - c. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.
- D. Panels and Doors:
 - 1. Panels:
 - a. Fabrication: Formed and reinforced, with same materials and insulation thickness as casing.
 - b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against airflow.
 - c. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - d. Size: Large enough to allow unobstructed access for inspection and maintenance of unit's internal components.
 - 2. Doors:

- a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
 - b. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against airflow. Provide safety latch retainers on doors so that doors do not open uncontrollably.
 - c. Gasket: Neoprene, applied around entire perimeters of panel frames.
 - d. Size: Large enough to allow unobstructed access for inspection and maintenance of unit's internal components.
3. Locations and Applications:
- a. Fan Section: **Doors**
 - b. Access Section: Doors.
 - c. Gas-Fired Burner Section: **Doors**.
 - d. Damper Section: **Doors**.
 - e. Filter Section: **Doors** large enough to allow periodic removal and installation of filters.

2.5 OUTDOOR-AIR INTAKE HOOD

- A. Type: Manufacturer's standard hood or louver.
- B. Materials: Match cabinet.
- C. Bird Screen: Comply with requirements in ASHRAE 62.1.
- D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.6 ROOF CURBS

- A. Roof curbs with seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
 - 1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
 - a. Materials: ASTM C 1071, Type I or Type II.
 - b. Thickness: 2-inches
 - 2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
 - a. Liner Adhesive: Comply with ASTM C 916, Type I.
 - b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
 - c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
 - d. Liner Adhesive: Comply with ASTM C 916, Type I.
- C. Curb Height: 20-inches high

- D. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match unit, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

2.7 FANS, DRIVES, AND MOTORS

- A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- B. Fans: Centrifugal, rated according to AMCA 210; galvanized steel; mounted on solid-steel shaft.
 - 1. Shafts: With field-adjustable alignment.
 - 2. Shaft Bearings: Heavy-duty pillow-block bearings with an L50 rated life of 100,000 hours according to ABMA 9.
 - 3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
 - 4. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
 - 5. Shaft Lubrication Lines: Extended to a location outside the casing.
 - 6. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch-thick, galvanized-steel sheet.
 - a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.
- C. Motors:
 - 1. Motor Sizes: Maximum sizes as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Enclosure: Open, drip proof Retain "Enclosure Materials," "Motor Bearings," "Unusual Service Conditions," "Efficiency," and "NEMA Design" subparagraphs below if options are available from equipment manufacturers and are different from default requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment." Consider each subparagraph and retain only those that vary from default requirements.
 - 3. Enclosure Materials: Cast iron.
 - 4. Efficiency: Premium efficient as defined in NEMA MG 1.

2.8 DAMPERS

- A. Outdoor-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in parallel-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg.
- B. Electronic Damper Operators:
 - 1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
3. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism with external.
7. Power Requirements (Two-Position Spring Return): 24 V dc.
8. Temperature Rating: Minus 22 to plus 122 deg F.
9. Run Time: 120 seconds.

2.9 INDIRECT-FIRED GAS BURNER

- A. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47 and with NFPA 54.
- B. CSA Approval: Designed and certified by and bearing label of CSA.
- C. Burners: Stainless steel.
 1. Rated Minimum Turndown Ratio: 30 to 1.
 2. Fuel: Natural gas.
 3. Ignition: Electronically controlled electric spark with flame sensor.
 4. Gas Control Valve: Modulating.
 5. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, electronic-modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 6. High-Altitude Kit
- D. Venting, Power: Power vented, with integral, motorized centrifugal fan interlocked with gas valve.
- E. Heat Exchanger: Stainless steel.
- F. Heat-Exchanger Drain Pan: Stainless steel.
- G. Safety Controls:
 1. Gas Manifold: Safety switches and controls complying with ANSI standards and FM Global.
 2. Vent Flow Verification: Flame rollout switch.
 3. High Limit: Thermal switch or fuse to stop burner.
 4. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
 5. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
 6. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
 7. 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 on.
 8. Control Transformer: 24 V ac.

2.10 EVAPORATIVE COOLER SECTION

- A. Stainless Steel Drain Pan
- B. Media
 - 1. Glasdek.
- C. Manufacturer's evaporative Pump

2.11 CONTROLS

- A. Comply with requirements in Section 230923 "Direct Digital Control (DDC) System for HVAC" and controls drawings for control equipment and sequence of operation.
- B. Control Devices:
 - 1. Ionization-Type Smoke Detectors:
 - a. 24-V dc, nominal.
 - b. Self-restoring.
 - c. Plug-in arrangement.
 - d. Integral visual-indicating light.
 - e. Sensitivity that can be tested and adjusted in place after installation.
 - f. Integral addressable module.
 - g. Remote controllability.
 - h. Responsive to both visible and invisible products of combustion.
 - i. Self-compensating for changes in environmental conditions.
- C. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.
- D. Temperature Control:
 - 1. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
 - 2. Burner Control, Modulating: 20 to 100 percent modulation of the firing rate. 10 to 100 percent with dual burner units.

2.12 MATERIALS

- A. Steel:
 - 1. ASTM A36/A36M for carbon structural steel.
 - 2. ASTM A568/A568M for steel sheet.
- B. Stainless Steel:
 - 1. Manufacturer's standard grade for casing.
 - 2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.
- C. Galvanized Steel: ASTM A653/A653M.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine roughing-in piping, ducts, and electrical systems to verify actual locations of piping and electrical connections before equipment installation.
- B. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure units to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment.
- C. Install gas-fired units in accordance with NFPA 54.
- D. Install controls and equipment shipped by manufacturer for field installation with indirect, gas-fired heating and ventilating units.
- E. Adjust evaporative cooler float per manufacturer's instructions.

3.2 PIPING CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 1. Gas Piping: Comply with requirements in Section 231123 "Facility Natural-Gas Piping." 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.
- B. Drain: Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for traps and accessories on piping connections to condensate drain pans under condensing heat exchangers.
- C. Where installing piping adjacent to heating and ventilating units, allow space for service and maintenance.

3.3 DUCTWORK CONNECTIONS

- A. Duct Connections: Connect supply ducts to indirect-fired heating and ventilating units with flexible duct connectors. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain heating and ventilating units.

END OF SECTION 237423.16

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- 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.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: Five year(s) from date of Substantial Completion.
 - c. For Labor: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Basis of design products subject to compliance to the specified product on the drawing. Provide a product by one of the following manufacturers:
 - a. Mitsubishi.
 - b. Trane.
 - c. Lennox.
 - d. LG.
 - e. York.
 - f. Daikin.
 - g. Samsung
 - h. Or approved equal.

2.2 INDOOR UNITS 5 TONS OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type: Totally enclosed, fan cooled.
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - 2) Depth: A minimum of 1 inch deep.
 - b. Single-wall, galvanized steel sheet.
 - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - 1) Minimum Connection Size NPS 3/4.
 - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
7. Air Filtration Section:

2.3 OUTDOOR UNITS 5 TONS OR LESS.

- A. Air-Cooled, Compressor-Condenser Components:
 - 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll.
 - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant: R-410A.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
 - 3. Fan: Aluminum-propeller type, directly connected to motor.
 - 4. Motor: Permanently lubricated, with integral thermal-overload protection.
 - 5. Low Ambient Kit: Permits operation down to 45 deg F.
 - 6. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Drain Hose: For condensate.

2.5 CAPACITIES AND CHARACTERISTICS

- A. See drawings for capacities and characteristics.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units, level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 238239.16 - PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes propeller unit heaters with hot-water coils.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittals for submittal requirements.
- B. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1. Basis of design product, subject to compliance with the specified product on the drawing, provide a product by one of the following:
 - a. Modine.
 - b. Trane.
 - c. Reznor.
 - d. Sterling.

2.2 DESCRIPTION

- A. Assembly including casing, coil, fan, and motor in vertical and horizontal discharge configuration with adjustable discharge louvers.
- 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 HOUSINGS

- A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.4 COILS

- A. General Coil Requirements: Test and rate hot-water propeller unit-heater coils according to ASHRAE 33.
- B. Hot-Water Coil: Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.

2.5 FAN AND MOTOR

- A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.
- B. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CAPACITIES AND CHARACTERISTICS

- A. See drawings for capacities and characteristics.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install propeller unit heaters to comply with NFPA 90A.
- B. Install propeller unit heaters level and plumb.
- C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to propeller unit heater's factory, hot-water piping package. Install the piping package if shipped loose.
- D. Comply with safety requirements in UL 1995.
- E. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of propeller unit heater. Hydronic specialties are specified in Section 232116 "Hydronic Piping Specialties."
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 238239.16

SECTION 238239.19 - WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.2 ACTION SUBMITTALS

- A. See Section 013300 – Submittal requirements.
- B. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and 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. Include details of anchorages and attachments to structure and to supported equipment.
 - 4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 5. Wiring Diagrams: Power, signal, and control wiring.
- D. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Berko; Marley Engineered Products.
 - b. Chromalox, Inc.
 - c. Markel Products; TPI Corporation.
 - d. Marley Engineered Products.
 - e. QMark; Marley Engineered Products.

2.2 DESCRIPTION

- A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

- 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. Front Panel: **Stamped-steel louver**, with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's **standard** color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- C. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

- A. Fan: Aluminum propeller directly connected to motor.
- B. Motor: Permanently lubricated. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

- A. Controls: Unit-mounted thermostat.
- B. Electrical Connection: Factory wire motors and controls for a single field connection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wall and ceiling unit heaters to comply with NFPA 90A.
- B. Install wall and ceiling unit heaters level and plumb.
- C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 238239.19

SECTION 260001 – 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. 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.
 - 3. Provide meters, switchboards, panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system.
 - 4. Complete lighting system.
 - 5. Complete communication system.
 - 6. Complete Audio/Visual system.
 - 7. Connection of all appliances and equipment including Owner furnished equipment.
 - 8. Complete grounding system.

9. Complete temporary facilities for construction power.
10. 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: 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.
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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. Basis-of-Design Products: Where Specifications name a product, or refer to a product indicated on Drawings, and include a manufacturer or list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements

in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers or a comparable substitution.

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 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 260001

SECTION 260002 – 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 copies 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.

F. Summary of Project Closeout Items for Owner

1. Certificates of inspection and approval from authorities having jurisdiction.
2. Executed Guarantees and Product Warranties.
3. "Record" drawings.
4. Final shop drawings.
5. Final Erection drawings.
6. 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 260002

SECTION 260003 – 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.

3.2 SERVICE CONNECTION

- A. Obtain temporary service from Nevada 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.
 - 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 260003

SECTION 260503 – 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 260503

SECTION 260519 – 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.
- 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.

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- 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. Install wiring so conductors are not in tension in completed system.

- F. Form wiring neatly and group in circuit. Tie grouped conductors with nylon ties, T&B "Tyrap" or approved equivalent.
- G. Each conduit run shall be run complete end to end before conductors are installed.
- H. 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.
- I. 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.
- J. 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.
- K. 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
- L. Join and terminate copper conductors individually. Do not mix voltages in the same raceway.
- M. Provide lugs where not furnished as part of equipment - furnish as specified above, to connect all conductors.
- N. Furnish lugs for conductors #1/0 and larger with two bolt tongue or accepted equivalent single bolt tongue with anti-turn devices.
- O. 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.
- P. 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.
- Q. 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.
- R. DO NOT COMBINE CIRCUITS into more than three circuits per homerun unless specifically approved by the Consultant.
- S. Neutral conductors shall not be used for equipment grounding.
- T. Circuitry shall not be run in elevator shafts and hoistways.

- U. Provide a separate neutral and grounding conductor for all GFI circuits or GFI devices to ensure an adequate ground-fault return path.

V. Conductors for receptacle and lighting circuits shall be installed in accordance with the following conditions:

Maximum one-way circuit length in feet for 90°C copper conductors with unity power factor to first device on circuit. Assumed 1920VA/120V, 4432VA/277V loading per circuit.

1. 120V – Single Phase
 - a. #12AWG – 53'
 - b. #10AWG – 88'
 - c. #8AWG – 138'
 - d. #6 AWG – 223'
2. 277V – Single Phase
 - a. #12AWG – 123'
 - b. #10AWG – 205'
 - c. #8AWG – 319'
 - d. #6AWG – 515'

- W. Panelboards may not be used as raceways.
- X. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- Y. Install terminal lugs on ends of 600-volt wires unless lugs are furnished on connected device, such as circuit breakers.
- Z. 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.
- AA. 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.
- BB. Clean conductor surfaces before installing lugs and connectors.
- CC. 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 260519

SECTION 260526 – 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: 8 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 260529 – 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.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.

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.**

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 260529

SECTION 260530 – 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. Risk Category: III
 - 2. Site Class Category: D
 - 3. Seismic Design Category: D
 - 4. See Sheet S001 Basis of Design for additional information.
- 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 $F_a=1.0$, and spectral response accelerations of $S_s=1.999g$, $S_1=0.649g$ are used. The test response spectrum shall be based upon a 5% damping factor, and a peak (S_d s) 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. Pendant 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 260530

SECTION 260533 – 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.

- 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 $\frac{3}{4}$ " conduit. Conduit not allowed to be run within slab on grade.
- D. Outdoor Locations, Above Grade: Provide rigid steel conduit and electrical metallic tubing. 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 $\frac{3}{4}$ " conduit. 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.

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 fer alloy. 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. Exterior buried conduit shall be scheduled 40 PVC with PVC coated RGS 90 degree bends when penetrating through floor slabs.
- Z. Use rigid steel conduit for all motor circuits where subject to physical damage.
- AA. Intermediate grade metal conduit, (threaded only), may be used in lieu of rigid steel conduit where allowed by NEC.
- BB. 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'.
- CC. 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.
- DD. EMT shall not be installed underground and shall not be encased in concrete.
- EE. Conduit must be installed high enough above lay in ceiling to permit removal of ceiling panels and light fixtures.
- FF. 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.
- GG. In accordance with NEC 300.4 conduit may not be run exposed across roof.
- HH. 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.
- II. Route underground conduits minimum 24" below grade.
- JJ. Paint conduit threads exposed to moisture with exterior grade, rust preventive silver paint after installation.
- KK. 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.
- LL. Vibrating equipment and equipment requiring adjustment, i.e.: motors, transformers, etc: make final connections with flexible metal conduit.
- MM. 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.
- NN. 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.
- OO. All conduit penetrations through or within CMU walls shall be rigid steel. Conduit run within CMU walls encased in concrete shall be PVC.

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. Where outlet boxes are installed in unfinished concrete walls or columns, provide 1" deep plaster ring with box and ring set in position before the concrete is poured so concrete will fill around the ring and cover plate can be installed flush with the

unfinished surface. In case of brick walls, follow same procedure with mason filling around the plaster ring with mortar.

- S. Install all outlets located on columns or walls, provide 6" x 6" x 3" deep wood box placed in the forms before concrete is poured. Remove wood box before waterproofing is applied. General Contractor will waterproof wall and opening, after which Electrical Contractor will install outlet box. General Contractor will grout around box. Set boxes carefully so that cover plates will be flush with the surface and square.
- T. **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. See 1/S021.**

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 260533

SECTION 260553 – 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 260553

SECTION 260573 – OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes short circuit and protective device coordination study encompassing portions of electrical distribution system from normal power source or sources up to and including breakers in service entrance switchboard, fuses in service entrance switchboard, main breaker in sub-distribution panels, fuses in sub-distribution panels and main breaker in each panelboard.
- B. Related Sections:
 - 1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
 - 2. Section 26 22 00 - Low-Voltage Transformers.
 - 3. Section 26 24 13 - Switchboards.
 - 4. Section 26 24 16 - Panelboards.
 - 5. Section 26 28 13 - Fuses.
 - 6. Section 26 28 19 - Enclosed Switches.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.

1.3 DESIGN REQUIREMENTS

- A. Complete Short Circuit and Protective Device Coordination Study to meet requirements of NFPA 70 and NEC 700.27 for selective coordination.
- B. Report Preparation:
 - 1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
 - 2. Perform study with aid of computer software program.
 - 3. Obtain actual settings for packaged chiller and motor characteristics and for equipment incorporated into Work.
 - 4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
 - a. Utility supply bus.
 - b. Low-voltage switchgear.
 - c. Switchboards.
 - d. Motor control centers.
 - e. Distribution panelboards.
 - f. Branch circuit panelboards.

- g. Busway.
 - h. Each other significant equipment location throughout system.
 - 5. Starting point for study shall be at 10 milliseconds.
- C. Report Contents:
 - 1. Include the following:
 - a. Calculation methods and assumptions.
 - b. Base per unit value selected.
 - c. One-line diagram.
 - d. Source impedance data including power company system available power and characteristics.
 - e. Typical calculations.
 - 1) Fault impedance.
 - 2) X to R ratios.
 - 3) Asymmetry factors.
 - 4) Motor fault contribution.
 - 5) Short circuit kVA.
 - 6) Symmetrical and asymmetrical phase-to-phase and phase-to-ground fault currents.
 - 7) Tabulations of calculation quantities and results.
 - f. One-line diagram revised by adding actual instantaneous short circuits available.
 - g. State conclusions and recommendations.
 - 2. Prepare time-current device coordination curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.
 - 3. Prepare with each time-curve sheet complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet.
 - 4. Prepare detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
 - 5. Plot device characteristic curves at point reflecting maximum symmetrical fault current to which device is exposed. Include on curve sheets the following:
 - a. Power company relay characteristics.
 - b. Power company fuse characteristics.
 - c. Low voltage equipment circuit breaker trip device characteristics.
 - d. Low voltage equipment fuse characteristics.
 - e. Cable damage point characteristics.
 - f. Pertinent transformer characteristics including:
 - 1) Transformer full load current.
 - 2) Transformer magnetizing inrush.
 - 3) ANSI transformer withstand parameters.
 - 4) Significant symmetrical fault current.
 - g. Pertinent motor characteristics.
 - h. Other system load protective device characteristics.

1.4 ARC FLASH HAZARDS ANALYSIS STUDIES

- A. Scope of Study
Determine the short-circuit current available at the designated point of contact and perform the following to provide adequate protection:
1. Calculate the flash protection boundary
 2. Calculate the arc-flash incident energy.
 3. Confirm the required labeling.
 4. Confirm the required personal protective equipment with arc rating to provide adequate protection for personnel working on or near energized conductors or components.
- B. Procedure
The actual short-circuit available current is to be determined from a recent short circuit study. If the actual short-circuit is not known, calculate incident energy using the nearest transformer that would supply the fault current. The flash protection boundary will be calculated in accordance with NFPA 70E. The arc-flash incident energy is to be calculated using the equations in NFPA 70E.
- Provide Warning Labels on all switchboards, panelboards and motor control centers for "Arc Flash and Shock Hazard Appropriate PPE Required" listing the following:
1. Available 3 phase Short-Circuit Current
 2. Flash Protection Boundary
 3. Incident energy at 18" expressed in cal/cm²
 4. PPE required
 5. Voltage shock hazard
 6. Limited shock approach boundary
 7. Restricted shock approach boundary
 8. Prohibited shock approach boundary

1.5 SUBMITTALS

- A. General Conditions: Requirements for submittals.
- B. Qualifications Data: Submit the following for review prior to starting study.
1. Submit qualifications and background of firm.
 2. Submit qualifications of Professional Engineer performing study.
- C. Software: Submit for review information on software proposed to be used in performing study.
- D. Product Data: Submit the following:
1. Report: Summarize results of study in report format including the following:
 - a. Descriptions, purpose, basis, and scope of study.
 - b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
 - c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

- d. Fault current calculations including definition of terms and guide for interpretation of computer printout.
- E. Submit copies of final report signed by professional engineer. Make additions or changes required by review comments.

1.6 QUALITY ASSURANCE

- A. Maintain one copy of each document on site.
- B. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of 5 years documented availability approved by Architect/Engineer.
- C. Perform study in accordance with IEEE 242.

1.7 QUALIFICATIONS

- A. Study Preparer: Company specializing in performing work of this section with minimum 5 years documented experience.
- B. Perform study under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Nevada with minimum of five years experience in power system analysis.
- C. Demonstrate company performing study has capability and experience to provide assistance during system start up.

1.8 PRE-INSTALLATION MEETINGS

- A. General Conditions: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 SEQUENCING

- A. General Conditions: Requirements for sequencing.
- B. Allow for review of completed study by Architect/Engineer.
- C. Submit short circuit and protective device coordination study to Architect/Engineer prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.
- D. When formal completion of study will cause delay in equipment manufacturing, obtain approval from Architect/Engineer for preliminary submittal of study data sufficient in scope to ensure selection of device ratings and characteristics will be satisfactory.

1.10 SCHEDULING

- A. General Conditions: Requirements for scheduling.
- B. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

1.11 COORDINATION

- A. General Conditions: Requirements for coordination.
- B. Coordinate work with local power company.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. General Conditions: Field inspecting, testing, adjusting, and balancing.
- B. Provide assistance to electrical distribution system equipment manufacturer during start up of electrical system and equipment.
- C. Select each primary protective device for delta-wye connected transformer so device's characteristic or operating band is within transformer characteristics, including point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection.
- D. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by 16 percent current margin to provide proper coordination and protection in event of secondary line-to-line faults.
- E. Separate medium-voltage relay characteristic curves from curves for other devices by at least 0.4 second time margin.

3.2 ADJUSTING

- A. General Conditions: Requirements for starting and adjusting.
- B. Perform field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Adjust settings in accordance with approved short circuit and protective device coordination study.

END OF SECTION 260573

SECTION 260923 – LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Remote control lighting relays.
 - 2. Lighting contactors.
 - 3. Switches.
 - 4. Switch plates.
 - 5. Occupancy sensors.
 - 6. Photocells.
 - 7. Photocell control unit.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.
 - 2. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
 - 3. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Product requirements for raceway and boxes for placement by this section.
 - 4. Section 26 05 53 - Identification for Electrical Systems: Product requirements for electrical identification items for placement by this section.
 - 5. Section 26 24 16 - Panelboards.
 - 6. Section 26 27 26 - Wiring Devices: Product requirements for wiring devices for placement by this section.

1.2 SYSTEM DESCRIPTION

- A. Distributed switching control using self contained individually mounted lighting relays.
- B. Where indicated on drawings or required by applicable code, provide automatic shutoff for lighting inside building larger than 5000 square feet (465 square meters). Control shutoff by method conforming to ICC IECC.
- C. Where indicated on drawings or required by applicable code, provide automatic shutoff for lighting outside building. Control shutoff by method conforming to ICC IECC.
- D. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is the intent of this section to provide an integrated, energy saving lighting control system including Lighting Control Panels and Occupancy Sensors, and Daylighting Controls from a single supplier. Contractor is responsible for confirming that the panels and sensors interoperate as a single system.

1.3 SUBMITTALS

- A. General Conditions: Requirements for submittals.

- B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
 - 1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches or devices.
 - 2. Include typical wiring diagrams for each component.
 - 3. Detailed point to point wiring diagrams and floor plans showing occupancy and daylighting sensor locations.
 - 4. Provide typical mounting details for all equipment and devices.
 - 5. Sample calibration log.
 - 6. Provide Source Code and Source Code Licenses for all equipment that is computer driven. Provide Development licenses so Source Code can be examined. These Development Licenses, along with all software licenses shall become property of the Owner. Third parties will be allowed to use the software as necessary for this project.
- C. Product Data: Submit manufacturer's standard product data for each system component.
- D. Manufacturer's Installation Instructions: Submit for each system component.
- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. General Conditions: Requirements for submittals.
- B. Project Record Documents: Record the following information:
 - 1. Actual locations of components and record circuiting and switching arrangements.
 - 2. Wiring diagrams reflecting field installed conditions with identified and numbered, system components and devices.
- C. Operation and Maintenance Data:
 - 1. Submit replacement parts numbers.
 - 2. Submit manufacturer's published installation instructions and operating instructions.
 - 3. Recommended renewal parts list.
 - 4. Submit final calibration log.

1.5 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Comply with NEC, NEMA, and FCC Emission requirements for Class A applications.
- C. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Configured to order or custom relay panels shall be UL Listed under UL 508, Industrial Control Panels.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the consultant.

1.7 PRE-INSTALLATION MEETINGS

- A. General Conditions: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section. Attendance required: Electrical Contractor, Factory Representative, Local Factory Representative and Outside Commissioning Agent.

Review placement of all components, wiring schematics and samples.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. General Conditions: Requirements for transporting, handling, storing, and protecting products.
- B. Accept components on site in manufacturer's packaging. Inspect for damage.
- C. Protect components by storing in manufacturer's containers indoor protected from weather.

1.9 WARRANTY

- A. General Conditions: Requirements for warranties.
- B. Furnish five year manufacturer warranty for components.

1.10 EXTRA MATERIALS

- A. General Conditions: Requirements for extra materials.
- B. Furnish 5 of each switch type installed.
- C. Furnish 5 of each occupancy sensor type installed.
- D. Furnish 1 of each photocell type.

PART 2 - PRODUCTS

2.1 RELAY PANELS

- A. System Description
Lighting Control Panels shall be UL listed and consist of the following:

LIGHTING CONTROL DEVICES

1. Enclosure/Tub: NEMA 1 as indicated on the drawings, sized to accept an interior with 24 relays and six (6) four pole contactors.
 2. Cover: Surface or Flush as required, hinged, and lockable and with restricted access to line voltage section.
 3. Interior: Barrier included for separation of high voltage (class 1) and low voltage (class 2) wiring. The interior shall include intelligence boards, power supply, mechanically latched control relays and multi-pole contactors. The interiors will include the following features:
 - a. Screwless, removable, plug-in connections for all low voltage terminations.
 - b. Each relay shall be capable of individual ON/OFF control by a low voltage switch and/or occupancy sensor input.
 - c. The system shall monitor true relay status; the relay status will be displayed at the onboard pilot LED and monitored by the system electronics.
 - d. Stagger the ON and OFF sequence of the relays.
 - e. Heavy Duty Relays – Mechanically latching contacts with single moving part design for improved reliability. Relays to have the following characteristics:
 - (1) 30 amp NEMA 410 electronic ballast rated and 20 amp tungsten, rated for 50,000 ON/OFF cycles at full load, Support #12 - #14 AWG solid or stranded wire and rated for 120, and 277 volts; 20 amp NEMA 410 electronic ballast rated and 20 amp tungsten 347 volts.
 - (2) 30 VAC isolated contacts for status feedback and pilot light indication.
 - (3) 14,000 amp short circuit current rating.
 4. Contactors shall be DIN rail mounted, four pole standard, normally open or normally closed, electrically held with 120 or 277 volt coil voltage to match panel control power voltage. Contactors shall be compatible with all lighting, ballast and HID loads and be rated for 277 volt 20 amp tungsten and 600 volt 30 amp ballast loads.
- B. Power Supply: Multi-voltage transformer assembly with enough power to supply all electronics, occupancy sensors, dataline 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.

2.2 NETWORK CLOCK

- A. Provide an eight channel network clock that connects to the system using the four conductor data communications wire network described in Section 2.10.
- B. The clock will be used to schedule any of the eight global channel groups (Section 2.03) in the relay panel network. The clock will support all of the energy saving features required of ASHRAE 90.1 - 2001, IECC 2003, as well as all state and local energy codes.
- C. The clock will provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and EEPROM for program retention. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.

- D. The clock shall allow unique scenario and time delays. Scenarios are:
 - 1. Scheduled ON / OFF
 - 2. Manual ON / Scheduled OFF
 - 3. Manual ON / Auto Sweep OFF (for AS-100 Switches)
 - 4. Astro ON / OFF (or Photo ON / OFF)
 - 5. Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
- E. The clock shall include system diagnostic functions to identify devices anywhere on the network dataline, and will function as a dataline switch programming tool.
- F. Features
 - 1. Clear 8-line, 22-character per line display and a simple user interface and online help.
 - 2. Retains memory and time for a minimum of 10 years.

2.3 NATIVE BACnet INTEGRATION

- A. Description
 - 1. Lighting Control Panels shall have a BACnet card with the capability to modify the IP address at the job site. The controller shall be furnished with all hardware/software required to field modify the IP address.
 - 2. BACnet card shall allow interface with the direct digital control system via BACnet / MSTP protocol.

2.4 ETHERNET MULTI-USER CONNECTIVITY - WEBLINK

- A. System Description
 - 1. A network appliance will provide multi-user, simultaneous access to the lighting system using standard TCP/IP and the manufacturer's software.
 - 2. The network appliance will include the following hardware:
 - a. Ethernet, Serial and Parallel port, optional 56K BAUD internal modem, Video graphics card.
- B. Features
 - 1. Multiple users (each with a licensed copy of the manufacturer's software will be able to simultaneously connect to the IP address of the WebLink.
 - 2. Users may be connected via an Intranet, or Internet depending upon network security limitations.
 - 3. A single user may connect using the manufacturer's software, via the internal modem of the WebLink.
 - 4. The WebLink will provide all the features of a direct connected site to the simultaneous users.
- C. Optional 365 day and Events Scheduler (Schools, Retail and Event Centers)
 - 1. 365 day event scheduling will allow "Events" to be defined as a series of commands to allow a preprogrammed timed sequence to occur by selecting the start time and stop time of the event. Events may be programmed as a repeating schedule with specific start and ending times or as one time scheduled events.

2. 365 day programming will simplify single day activities for schools, retail applications, or event centers. The schedules may be programmed up to two years in advance.

D. 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.

2.5 LOW VOLTAGE SWITCHES / PLATES

A. Description

1. Low voltage switches shall provide a momentary signal to allow individual relay control or group control using the Group Switching card specified in Section 2.03 above. Switches shall be available in 1-button, 3-button, 5-button, or 9-button designs. The 1, 3, and 5 switch devices shall mount in a standard single gang box: the 9-switch version in a two-gang box.

B. Features

1. Switches shall be constructed of non-breakable Lexan on all exposed parts and shall include a matching screwless Lexan wall plate.
2. **Individual buttons shall be labeled and identified to their use with either removable faceplates or permanent engraving on the button.**
3. Each switch shall use an LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays.

2.6 OCCUPANCY SENSORS AND POWER PACKS

A. Occupancy Sensors

1. All products listed shall integrate fully with the Lighting Control Panels and daylighting controls listed in the project specifications.
2. 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 or microphonic technologies for occupancy detection. Products that react to noise or ambient sound shall have sophisticated filtering technology to mask out and recognize noises made by the building or the environment such as the sound of the HVAC system, air currents, equipment, cars driving by, etc. They shall also have automatic gain control to dynamically self-adapt to the environment by filtering out constant background noise.
5. 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 $\pm 0.005\%$ tolerance, 32 kHz within $\pm 0.002\%$ tolerance, or 40 kHz $\pm 0.002\%$ tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
 - 6. All sensors shall be capable of operating normally **with LED Drivers**.
 - 7. 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.
 - 8. 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.
 - 9. 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.
 - 10. 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.
 - 11. **The lighting controls contractor/supplier shall provide sensors adequate for the use in each space and individual device selection shall be made with regards to ceiling heights and specific installation location. It is the contractor's responsibility to select appropriate sensors with varying coverage ranges for each space where required to be provided with occupant sensor control. Additional devices shall be provided at no cost to the owner to provide best level of detection and energy savings. All documents in the project shall be reviewed with regards to mounting heights and obstructions in the space.**
- B. 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. 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
- C. 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.

2.7 EXTERIOR PHOTOCELLS

- A. Each photocell shall be mounted in the appropriate location for measuring the available daylight. Each photocell will have a separate control/calibration module mounted separately and in an accessible location.
- B. The control module shall:
 - 1. Have a separate trip point settings. These settings will be entered via easily readable dial switches.
 - 2. Have a fixed deadband of 10%.
 - 3. Have a starting delay.
 - 4. Be suitable for panel mounting.
 - 5. Be UL listed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount switches, occupancy sensors, and photocells as indicated on Drawings and by manufacturer's requirements. **Provide additional sensors as required to provide optimal detection in each space.**
- B. Install wiring in accordance with Section 26 05 19.
- D. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings. Install wire in conduit in accordance with Section 26 05 33.
- E. Label each low voltage wire clearly indicating connecting relay panel. Refer to Section 26 05 53.
- F. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to indicate originating panel designation.
- G. Label each low voltage wire with relay number at each switch or sensor.

3.2 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.
- H. 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 1-year 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 this time.**

3.3 ADJUSTING AND CALIBRATING

- A. General Conditions: Requirements for starting and adjusting.
- B. Test each system component after installation to verify proper operation.
- C. Test relays, contactors, and switches after installation to confirm proper operation.
- D. Confirm correct loads are recorded on directory card in each panel.
- E. Provide calibration logs for all devices. Sample log shall be part of shop drawing submittal.

CONTROL TYPE	COMMISSIONING AND CALIBRATION
Occupancy sensors and photosensors	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).
Daylight harvesting	All furnishings and interior finishes and materials should be installed before calibrating the sensors. Adjust the photosensor to determine the threshold for switching based on detected light level. It may be helpful to calibrate under normal daylight conditions and dusk conditions (it may be possible to close window blinds to approximate dusk). Record the calibration adjustments if possible and replicate in similar spaces.
Automatic shut-off (“sweep off”)	Input the schedule into the programmable scheduling controls, incorporating weekday, weekend and holiday operating times. Ensure that overrides work and that they are located conveniently for users.
Dimming systems	It is recommended that fluorescent lamps be “seasoned” before dimming by operating them at full light output, so as to ensure uniform dimming performance across all lamps in a system. Recommendations vary, but NEMA recommends seasoning fluorescent linear lamps overnight, or about 12 hours, and compact fluorescent lamps for 100 hours, prior to dimming. Consult the lamp manufacturer to determine whether the select lamp type must be seasoned and for how long prior to dimming.
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.

END OF SECTION 260923

SECTION 262200 - 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 262200

SECTION 262413 – 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.
- 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.
- 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 262413

SECTION 262416 – PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution and branch circuit panelboards.
 - 2. Electronic grade 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

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.

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 Suppressors: Integrated in panelboard, refer to Section 26 35 53.
6. Enclosure: NEMA PB 1, Type 1 or 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
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Square D	NQOD	NF	I-Line
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 panelboards 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 ELECTRONIC GRADE PANELBOARD

A. Description:

1. Integral Surge Suppressor: Component recognized in accordance with UL 1449 and UL 1283.
2. Panelboard: UL 67 listed and TVSS device UL 1449 Component Recognized. TVSS device meets UL 1449. Furnish panelboard markings with clamp voltage at TVSS terminals and clamp voltage at panelboard line terminals.

B. Performance:

1. Integral Surge Suppressors:
 - a. Meet or exceed the following criteria:
 - 1) Maximum single impulse current rating not less than 200 kA for each phase.
 - 2) Pulse Lift Test: Capable of protecting against and surviving 5000 IEEE C62.41 Category C transients without failure or degradation.
 - 3) Clamping voltage not exceeding the following:

Voltage	L-N	N-G	L-G
208Y/120	500 V	500 V	500 V
480Y/277	1000 V	1000 V	1000 V

C. Fabrication:

1. Integral Surge Suppressor:
 - a. Furnish copper bus bars for surge current path.
 - b. Construct using surge current modules (MOV based). Each module fused with user replaceable 200,000 AIR rated fuses. Status of each module monitored on front cover of panelboard enclosure and on module.
 - c. Furnish with audible alarm activated when one of surge current modules has failed. Furnish alarm on/off to silence alarm and alarm push-to-test switch to test alarm. Locate switches and alarm on front cover of panelboard enclosure.
 - d. Furnish response time no greater than five nanoseconds for individual protection modes.
 - e. Designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
 - f. Furnish visible indication of proper suppresser connection and operation. Lights indicate operable phase and module.
 - g. Furnish minimum EMI/RFI filtering of 34 dB at 100 kHz with insertion loss ratio of 50: 1 using Mil Std. 220A methodology.
2. Panelboards
 - a. Top or bottom feed as indicated on Drawings. Furnish circuit directory inside door.
 - b. Construct box of galvanized steel. Box size as indicated on Drawings.
 - c. Main bus constructed of copper and rated for load current.

- d. Furnish interior with branch circuit breakers. Furnish one 60-amp circuit breaker, with appropriate number of poles, as dedicated disconnect for TVSS.
- e. Furnish 200 percent rated neutral assembly with copper neutral bus.
- f. Furnish with insulated ground bus and safety ground bus.
- g. Furnish wiring gutters in accordance with NEC.
- h. Field connections to panelboard: As indicated on drawings.
- i. Construct with flush or surface mounted trim and NEMA Type 1 or 3R enclosure, as indicated on drawings.
- j. Furnish with branch breaker positions and nominal current rating as indicated on Drawings.

2.4 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 3/4" 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 existing panelboards to remain or to be reinstalled.

END OF SECTION 262416

SECTION 262716 - 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 262716

SECTION 262726 – 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 $\pm 0.005\%$ tolerance, 32 kHz within $\pm 0.002\%$ tolerance, or 40 kHz $\pm 0.002\%$ 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 or match existing, nylon. Provide red device for receptacles on standby emergency power.
- 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 or to match existing. Provide red cover/plate for red receptacle unless noted otherwise.
- C. Jumbo Cover Plate: White or to match existing.
- D. Weatherproof Cover Plate: Gasketed cast metal plate with hinged and gasketed device cover. 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.

2.5 MODULAR RECEPTACLE

- A. Manufacturers:
 - 1. Cooper – Arrow Link.
 - 2. Leviton – Lev-Lok.
 - 3. Hubbel – SNAPConnect.
 - 4. Legrand – PlugTail.
 - 5. Substitutions: Not Permitted.
- B. Description:

Manufactured UL Assembly, 20Amp, 120V, heavy duty, locking type straight blade or twist on modular connector with or without pigtails.

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 262726

SECTION 262813 - 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 262813

SECTION 262819 - 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: Type 3R.
 - 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 262819

SECTION 263213 – PACKAGE GENERATOR SET

PART 1 - GENERAL

1.1 REFERENCES AND STANDARDS

The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards below:

- CSA C22.2 No14
- CSA 282
- CSA 100
- EN61000-6
- EN55011
- FCC Part 15 Subpart B
- ISO8528
- IEC61000
- UL508
- UL2200
- UL142
- Designed to allow for installed compliance to NFPA 70, NFPA99 and NFPA 110
- **IBC 1.5**

1.2 RELATED SECTIONS

- A. Division 3 - Concrete
- B. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.3 WORK INCLUDED

- A. Installation
The work includes supplying and installing a complete integrated generator system. The system consists of a diesel generator set with related component accessories. All major parts shall be manufactured and assembled by a single manufacturer.
- B. Fuel System
The CONTRACTOR shall provide a full tank of diesel fuel for the completion of all testing. A full tank of fuel shall also be furnished at completion of project.
- C. System Test
A complete system load test shall be performed after all equipment is installed. See guidelines in the Start-up Section.
- D. Requirements, Codes and Regulations

The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

1.4 MANUFACTURERS

- A. Caterpillar
- B. Detroit Diesel
- C. Generac
- D. Or approved equal

1.5 SUBSTITUTIONS

- A. See General Conditions

1.6 SUBMITTALS

- A. Engine-generator submittals shall include the following information:
 - 1. Factory published specification sheet.
 - 2. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, control panel, enclosure, etc.
 - 3. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
 - 4. Weights of all equipment.
 - 5. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
 - 6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, control panel, and remote alarm indications.
 - 7. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, fuel consumption, etc.
 - 8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
 - 9. Generator resistances, reactances and time constants.
 - 10. Generator locked rotor motor starting curves.
 - 11. Manufacturer's and dealer's written warranty.
 - 12. **Provide technician's names and factory training certificates of those who will be working on the genset on site.**

1.7 SYSTEM RESPONSIBILITY

- A. Generator Set Distributor
The completed engine generator set shall be supplied by the Manufacturer's authorized distributor only.
- B. Requirements, Codes and Regulations
The equipment supplied and installed shall meet the requirements of NEC and all-applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory trained service personnel.
- C. Automatic Transfer Switch
The automatic transfer switch(es) specified in another section shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination.

1.8 WARRANTY

- A. Two Year Standby (ISO 8528-1: ESP) Generator Set Warranty
The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Running hours shall be limited to 500 hours annually for the system warranty by both the manufacturer and servicing distributor. Submittals received without written warranties as specified will be rejected in their entirety.

1.9 PARTS AND SERVICE QUALIFICATIONS

- A. Service Facility
The engine-generator supplier shall maintain 24-hour parts and service capability within **50 miles** of the project site. The distributor shall stock parts as needed to support the generator set package for this specific project. The supplier must carry sufficient inventory to cover no less than 80% parts service within 24hrs and 95% within 48 hours.
The above supplier shall have 3 or more service trucks within 50 miles of the project site. The supplier shall have an oil, fuel, coolant lab for testing samples at their location to process samples in 24 hours or less. The supplier must have a project manager, OSHA certified safety office in their location within 50 miles of the job site.
- B. Service Personnel
The dealer shall maintain qualified factory trained service technicians within **50 miles**.

PART 2 - PRODUCT SPECIFICATIONS

2.1 GENERAL REQUIREMENTS

A. Genset Requirements

The generator set shall be Standby/ESP Duty rated at 80ekW/100kVA, 0.8 power factor, 480V, 3-Phase, 60 hertz, including radiator fan and all parasitic loads. Generator set shall be sized to operate at the specified load at a maximum ambient of 104F and altitude of 4500 feet .

The generator set shall be sized to recover 90% of the rated voltage and 90% of the rated frequency within two seconds (120 cycles) at project site location/conditions (altitude/temperature).

Standby Rating as defined by the following:

Power is available for the duration of an emergency outage

Average power output = 70% of ESP rating

Load = Varying

Typical Hours per Year = 200 hours

Maximum Expected Usage = 500 hours/year

B. Material and Parts

All materials and parts comprising the unit shall be new and unused.

See Spec Section 260530 for seismic requirements.

C. Engine

The engine shall be diesel fueled, four (4) cycle, water-cooled, while operating with nominal speed not exceeding 1800 RPM. The engine will utilize in-cylinder combustion technology, as required, to meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 – D2 Emissions Cycle at specified ekW / bHP rating. Utilization of the “Transition Program for Equipment Manufacturers” (also known as “Flex Credits”) to achieve EPA certification is not acceptable. The in-cylinder engine technology must not permit unfiltered exhaust gas to be introduced into the combustion cylinder. Emissions requirements / certifications of this package: EPA T3.

1. Engine Governing

The engine will be equipped with an isochronous electronic governor to maintain +/- 6 RPM steady state frequency variation from steady state no load to steady state full load.

2.2 GENERATOR

A. Generator Specifications

The synchronous three phase generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling. The generator shall meet performance class G2 of ISO 8528. The excitation system shall enable the alternator to sustain 300% (250% for 50Hz) of rated current based on the 125C (Class H) or 105C (Class F) rise rating for ten seconds during a fault condition and shall improve the immunity of the voltage regulator to non-linear distorting loads. The excitation system shall be of brushless construction and be independent of main stator windings (either permanent magnet or

auxiliary windings).

B. Voltage Regulator

The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The regulator shall be a totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, over-excitation protection, shall limit voltage overshoot on startup, and shall be environmentally sealed.

2.3 CIRCUIT BREAKER

A. Circuit Breaker Specifications

Provide generator mounted 100% circuit breakers, molded case, quantity (2) 225, and (1) 125 amp trip, 3 pole, NEMA 1/IP22. Breakers shall utilize a solid state trip unit with LSI adjustment. The breakers shall be UL/CSA Listed and connected to engine/generator safety shutdowns. Breakers shall be housed in an extension terminal box which is isolated from vibrations induced by the generator set. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing, shall be supplied on the load side of breaker.

Breakers shall be type as required by the required coordination study and shall provide a fully coordinated system. Changes to breaker type due to coordination study shall not result in additional costs to owner.

2.4 CONTROLS – GENERATOR SET MOUNTED

Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set.

A. Environmental

The generator set control shall be tested and certified to the following environmental conditions.

1. -40°C to +70°C Operating Range
2. 0-95% humidity non-condensing, 30°C to 60°C
3. IP22 protection for rear of controller; IP55 when installed in control panel
4. 5% salt spray, 48 hours, +38°C, 36.8V system voltage
5. Sinusoidal vibration 4.3G's RMS, 24-1000Hz
6. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)
7. Shock: withstand 15G

B. Functional Requirements

The following functionality shall be integral to the control panel.

1. The control shall include a minimum 33 x 132 pixel, 24mm x 95mm, positive image, transfective LCD display with text based alarm/event descriptions.
2. The control shall include a minimum of 3-line data display
3. Audible horn for alarm and shutdown with horn silence switch
4. Standard ISO labeling
5. Multiple language capability

6. Remote start/stop control
7. Local run/off/auto control integral to system microprocessor
8. Cool down timer
9. Speed adjust
10. Lamp test
11. Emergency stop push button
12. Voltage adjust
13. Voltage regulator V/Hz slope - adjustable
14. Password protected system programming

C. Digital Monitoring Capability

The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units.

Engine:

1. Engine oil pressure
2. Engine oil temperature
3. Engine coolant temperature
4. Engine RPM
5. Battery volts
6. Engine hours
7. Engine crank attempt counter
8. Engine successful start counter
9. Service maintenance interval
10. Real time clock
11. Engine exhaust stack temperature
12. Engine main bearing temperature

Generator:

1. Generator AC volts (Line to Line, Line to Neutral and Average)
2. Generator AC current (Avg and Per Phase)
3. Generator AC Frequency
4. Generator kW (Total and Per Phase)
5. Generator kVA (Total and Per Phase)
6. Generator kVAR (Total and Per Phase)
7. Power Factor (Avg and Per Phase)
8. Total kW-hr
9. Total kVAR-hr
10. % kW
11. % kVA
12. % kVAR
13. Generator bearing temperature
14. Generator stator winding temperature

Voltage Regulation

1. Excitation voltage
2. Excitation current

D. Alarms and Shutdowns

The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by an engine

hour stamp that are stored by the control panel for first and last occurrence.

Engine Alarm/Shutdown:

1. Low oil pressure alarm/shutdown
2. High coolant temperature alarm/shutdown
3. Loss of coolant shutdown
4. Overspeed shutdown
5. Overcrank shutdown
6. Emergency stop shutdown
7. Low coolant temperature alarm
8. Low battery voltage alarm
9. High battery voltage alarm
10. Control switch not in auto position alarm
11. Battery charger failure alarm

Generator Alarm/Shutdown:

1. Generator phase sequence
2. Generator over voltage
3. Generator under voltage
4. Generator over frequency
5. Generator under frequency
6. Generator reverse power (real and reactive)
7. Generator overcurrent

Voltage Regulator Alarm/Shutdown:

1. Loss of excitation alarm/shutdown
2. Instantaneous over excitation alarm/shutdown
3. Time over excitation alarm/shutdown
4. Rotating diode failure
5. Loss of sensing
6. Loss of PMG

E. Inputs and Outputs

Programmable Digital Inputs:

The Controller shall include the ability to accept programmable digital input signals.

The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.

Programmable Relay Outputs:

The control shall include the ability to operate programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC and consist of six (6) Form A (Normally Open) contacts and two (2) Form C (Normally Open & Normally Closed) contacts.

Programmable Discrete Outputs:

The control shall include the ability to operate two (2) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.

F. Maintenance

All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control

1. Engine running hours display
2. Service maintenance interval (running hours or calendar days)
3. Engine crank attempt counter
4. Engine successful starts counter
5. 40 events are stored in control panel memory
6. Programmable cycle timer that starts and runs the generator for a predetermined time. The timer shall use 7 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:
 - a. Day of week
 - b. Time of day to start
 - c. Duration of cycle

G. REMOTE COMMUNICATIONS

The control shall include Modbus RTU communications as standard via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k.

Remote Monitoring Software

The control shall provide Monitoring Software with the following functionality

1. Monitor up to eight (8) generator sets, plus ATS and UPS.
2. Provide access to all data and events on generator set communications network
3. Provide remote control capability for the generator set(s)
4. Ability to communicate via Modbus RTU or remote modem

H. LOCAL AND REMOTE ANNUNCIATION

Local Annunciator (NFPA 99/110, CSA 282)

Provide a local, control panel mounted, annunciator to meet the requirements of NFPA 110, Level 1.

1. Annunciators shall be networked directly to the generator set control
2. Local Annunciator shall include a lamp test pushbutton, alarm horn and alarm acknowledge pushbutton
3. Provide the following individual light indications for protection and diagnostics
 - a. Overcrank
 - b. Low coolant temperature
 - c. High coolant temperature warning
 - d. High coolant temperature shutdown
 - e. Low oil pressure warning
 - f. Low oil pressure shutdown
 - g. Overspeed
 - h. Low coolant level
 - i. EPS supplying load
 - j. Control switch not in auto
 - k. High battery voltage
 - l. Low battery voltage
 - m. Battery charger AC failure
 - n. Emergency stop
 - o. Spare

p. Spare

Remote Annunciator (NFPA 99/110, CSA 282)

Provide a remote annunciator to meet the requirements of NFPA 110, Level 1.

4. The annunciator shall provide remote annunciation of all points stated above and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.
5. Ability to be located up to 4000 ft from the generator set

2.5 COOLING SYSTEM

The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 110 F* ambient air entering the enclosure. The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

2.6 FUEL SYSTEM

A. Fuel System

The fuel system shall be integral with the engine. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted. Flexible fuel lines shall be minimally rated for 300 degrees F and 100 psi.

B. Fuel Sub Base Tank

Provide a double wall sub-base tank constructed to meet all local codes and requirements. A fuel tank base of 24-hour capacity shall be provided as an integral part of the enclosure. It shall be contained in a rupture basin with 110% capacity. The tank shall meet UL142 standards. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

Provide with main vent and emergency vent.

2.7 STARTING SYSTEM

A. Starting Motor

A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

B. Jacket Water Heater

Jacket water heater shall be provided and shall be sized to insure that genset will start within the specified time period and ambient conditions.

C. Batteries

Batteries - A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system.

D. Battery Charger

Battery Charger - A current limiting battery charger shall be furnished to automatically recharge batteries. The charger shall be dual charge rate with automatic switching to the boost rate when required. The battery charger shall be mounted on the genset package or inside the genset enclosure/room.

2.8 ENCLOSURE

A. Sound Attenuated Weatherproof Enclosure

The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, sound enclosure mounted on the fuel tank base.

1. A weather resistant, sound attenuated enclosure of steel with electrostatically applied powder coated baked polyester paint. The enclosure shall have a resulting sound level of 78dba @ 23ft with the genset running under full load. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel.
2. Enclosure Sound Attenuation: Acoustical foam shall be provided between all supports and inside doors and sound baffles on air intake and air discharge.
3. **Sound attenuated enclosure shall be painted white.**

PART 3 – EXECUTION

3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations, the project drawings and specifications, and all applicable codes.

3.2 START-UP AND TESTING

- A. Coordinate all start-up and testing activities with the Engineer and Owner. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following:

1. Perform a 4-hour Reactive Load Bank Test at .8PF and .9PF of full nameplate rating. Load bank, cables and other equipment required for this test to be supplied by the genset supplier.
2. Perform a 4-hour load test with true building load.

3.3 OPERATION AND MAINTENANCE MANUALS

Provide operation and maintenance manuals (quantity per General Conditions) covering the generator, switchgear, and auxiliary components. Include final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

3.4 TRAINING

A. On-Site Training

Provide **minimum of 2 hours** on-site training by **factory trained personnel** to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

END OF SECTION 263213

SECTION 263556 – 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 agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manufacturers of a Broad Line of Suppressors.
 - a. Liebert Corp.
 - b. Current Technology, Inc.
 - c. Eaton Cutler-Hammer (Externally Mounted SPD only).
 - d. Or equivalent.

2.2 SERVICE ENTRANCE 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.
- 2. Fusing system to provide 200kAIC short circuit rating.
- 3. Individually fused MOVs to provide system redundancy
- 4. Integral disconnect (only when a breaker is NOT provided in distribution equipment)

5. LED indicator lights for power and protection status.
 6. Audible alarm, with silencing switch, to indicate when protection has failed.
 7. One set of dry contacts rated at 5A and 250V ac, for remote monitoring of protection status.
 8. 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 60A, multi-pole circuit breaker in the service entrance equipment and a 30A, multi-pole circuit breaker in branch panel equipment to serve as a dedicated disconnect for suppressor, unless otherwise indicated.

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 263556

SECTION 263623 – AUTOMATIC TRANSFER SWITCH

PART 1 – GENERAL

1.1 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.

1.2 SCOPE

- A. It is the intent of this specification to secure a transfer switch that has been prototype tested, factory built, production tested and site tested. A transfer switch with the number of poles, voltage and current ratings shown on the plans and specified herein shall be provided.

1.2 CODES AND STANDARDS

- A. The automatic transfer switch shall conform to the requirements of:
 - 1. UL 1008: Underwriters Laboratories standard for automatic transfer Switches
 - 2. CSA: C22.2 No. 178 certified
 - 3. IEC: 947-6-1 certified at 480 VAC
 - 4. NFPA 70: National Electrical Code including use in emergency and standby systems in accordance with Articles 517, 700, 701, 702
 - 5. NFPA 101: Life safety code
 - 6. NFPA 110: Standard for emergency and standby power systems
 - 7. IEEE 241: I.E.E.E. recommended practice for electrical power systems in commercial buildings
 - 8. IEEE 446: I.E.E.E. recommended practice for emergency and standby power systems
 - 9. NEMA ICS10: AC automatic transfer switch equipment
 - 10. UL 50/508: Enclosures
 - 11. ICS 6: Enclosures
 - 12. ANSI C33.76: Enclosures
 - 13. NEMA 250: Enclosures
 - 14. IEEE 472: (ANSI C37.90A): Ringing wave immunity
 - 15. EN55022 (CISPR11): Conducted and radiated emissions (Exceeds EN55011 & MILSTD 461 Class 3)
 - 16. EN61000-4-2: (Level 4): ESD immunity test Class B:
 - 17. EN61000-4-3: (ENV50140): Radiated RF, electromagnetic field immunity
 - 18. EN61000-4-4: Electrical fast transient/burst immunity test
 - 19. EN61000-4-5: IEEE C62.41: Surge immunity test (1.2 x 50 μ s, 5 & 8 kV)

- 20. EN61000-4-6: (ENV50141): Conducted immunity test
- 21. EN61000-4-11: Voltage dips and interruption immunity
- 22. IBC 1.5: Seismic Requirements.

1.3 APPROVED MANUFACTURES

- A. Caterpillar – Model ATC Contactor Based Automatic Transfer Switch Series.
- B. ASCO
- C. Zenith
- D. Or approved equivalent.

PART 2 – PRODUCTS

2.1 PERFORMANCE AND CONSTRUCTION

- A. The closed transition automatic transfer switch shall be operated by a reliable dual-solenoid driven mechanism. There shall be direct mechanical couplings to facilitate transfer in 6 cycles or less. The closed transition ATS shall have a capability to operate in the delayed transition mode (with 'center-off' or 'neutral' switch position) on transfer from a failed source or when pre-selected to do so.
- B. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability will not be considered.
- C. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.
- D. The transfer switch manufacturer shall submit test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Each ATS shall be in strict accordance and listed to UL 1008 withstand standards, including 3 cycle ratings, 480V RMS, 20% power factor.
- E. A dielectric test shall be performed at the conclusion of the withstand and closing tests.
- F. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.

- G. All relays shall be continuous duty industrial type with wiping contacts. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.
- H. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
- I. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
- J. Switches composed of molded case breakers, lighting contactors or components thereof will not be acceptable.
- K. The current rating shall be a continuous rating when the switch is installed in an enclosure, and shall conform to NEMA temperature rise standards.
- L. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
- M. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.
- N. Unless specified otherwise on the drawings, the switch shall be mounted in a NEMA 1 enclosure.

2.2 Bypass-Isolation Switch

- A. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.
- B. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interwiring shall be provided with disconnect plugs.
- C. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.
- D. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic"

mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.

- E. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.
- F. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.
- G. Designs requiring operation of key interlocks for bypass isolation or ATSS which cannot be completely withdrawn when isolated are not acceptable.

2.3 CONTROL

- A. The control panel shall be opto-isolated from electrical noise and provided with the following inherent control functions and capabilities:
 - 1. Easy-to-view 4x20 LCD display with long lasting LED indicators.
 - 2. Control panel shall display voltage and frequency of both sources.
 - 3. The user shall be able to view the last 16 recorded events.
 - 4. Capability for external communication and network interface.
 - 5. Adjustments to all settings shall be made from the front of the panel without opening the door.
- B. The transfer switch shall be equipped with a microprocessor based control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position, source availability, sequence indication and diagnostics.
- C. All programmable and control functions shall be pass code protected and accessible through the keypad.
- D. The control panel shall be provided with a simple user interface for transfer switch monitoring, control and field changeable functions and settings.
- E. Touch pad test switch with Fast Test/Load/No Load selection capability to simulate a normal source failure.
- F. The controller shall include a built in synchroscope to display the phase angle differential and ensure disturbance-free transfer operation between sources.
- G. The controller shall provide digital timer adjustments with 1-second resolution. Voltage and Frequency shall be adjustable to 1% resolution to facilitate accurate transfer.

- H. To ensure reliable and consistent user operation the controls must be equipped with nonvolatile memory and allow automatic daylight savings time adjustment.
- I. Provide lockable cover for keypad.

PART 3 – OPERATION

3.1 SEQUENCE OF OPERATION

- A. The closed transition switch shall transfer the load in a parallel mode, thus momentarily connecting both sources of power. A closed transition transfer shall occur only when both sources are available and within specified limits. The transfer switch shall operate in an open transition mode when the power source servicing the load fails.
- B. The ATS shall incorporate adjustable three phase under/over voltage and frequency sensing on the normal source.
- C. When the voltage of any phase of the normal source is reduced to 80% of nominal voltage, for a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.
- D. The ATS shall incorporate adjustable three phase under/over voltage and frequency sensing on the emergency source.
- E. When the emergency source has reached a voltage value of 90% of nominal and achieved frequency within 95% of the rated value, the load shall be transferred to the emergency source after a programmable time delay.
- F. When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be retransferred to the normal source after a time delay of 0 to 60 minutes (programmable). The generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.
- G. If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.
- H. During closed transition operation, the control circuit shall monitor interconnect time. Should connection exceed 100 ms, the set of power contacts last closed shall reopen and an alarm circuit shall be energized. If the main contacts fail to open, the control system shall energize a 24 VDC shunt trip circuit to the standby feeder breakers to disconnect this source and the alarm circuit shall be closed. 24 VDC from the engine batteries shall be supplied for the shunt trip and backup circuits
- I. A sync check function shall be provided for closed transition operation. The monitor shall control transfer and retransfer between live sources and operate by sensing the

zero voltage point. It shall be factory set to accomplish transfer within 5 electrical degrees and +/-5% voltage differential. If closed transition transfer is not accomplished within 60 seconds, an alarm message shall be displayed to indicate the failure.

- J. Closed transition transfer in conjunction with over/under-voltage, phase rotation and angle sensing shall be accomplished when both sources are within specified parameters without any power interruption though passive synchronization. To ensure the utmost in compatibility, the ATS must be supplied by the same manufacturer of the engine generator set.

3.2 STANDARD ACCESSORIES

- A. Adjustable time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds factory set at 3 seconds.
- B. Adjustable time delay on retransfer to normal source, programmable 0-60 minutes factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.
- C. A time delay on transfer to emergency, programmable 0-5 minutes, factory set at 1 second.
- D. An in-phase monitor shall be provided. The monitor shall compare the phase angle difference between the normal and emergency sources and be programmed to anticipate the zero-crossing point to minimize switching transients.
- E. An exerciser timer with momentary test pushbutton shall be incorporated within the microprocessor and shall be capable of starting the engine generator set and transferring the load (when selected) for exercise purposes on a daily, weekly or monthly basis. The exerciser shall contain a battery for memory retention during an outage.
- F. Provide a momentary pushbutton to bypass the time delays on transfer and retransfer and programmable commit/no commit control logic.
- G. A set of customer contacts shall be provided to indicate both emergency and normal source position.
- H. An adjustable over/under frequency and voltage sensor for both emergency and normal sources.
- I. Indication of switch position and source acceptability shall be provided for both emergency and normal sources.
- J. An engine start contact with an adjustable cool down timer.
- K. A three phase Voltage Imbalance Monitor shall detect an imbalance and initiate a transfer to the alternate source. Adjustable 5-20% of nominal with a time delay of 10-30 seconds for nuisance conditions.

The following Exerciser Package shall be included:

- A. Additional Auxiliary Contact (A3) - Closed when the transfer switch is in Source 2 position.
- B. Additional Auxiliary Contact (A4) - Closed when the transfer switch is in Source 1 position.
- C. Programmable Clock Exerciser (CDP) – This will replace the timer exerciser and allow for a 365-day cycle.

The following additional accessories shall be included:

- A. Universal Motor Load Disconnect (UMD) - Auxiliary contacts opens 0 – 5 minutes prior to transfer in either direction, re-closes after transfer. Can be configured for pre-transfer, post transfer or both.
- B. Test Switch (6A) - Maintained
- C. Additional Auxiliary Contacts (A3) - Closed when the transfer switch is in Source 2 position.
- D. Additional Auxiliary Contacts (A4) - Closed when the transfer switch is in Source 1 position.
- E. Alarm panel (CTAP) – Alarm on transfer to emergency w/silence button & light
- F. Engine Mode Switch (SW1) – Three-position engine selector switch (auto/test/off).

PART 4 – EXECUTION

4.1 GENERAL

- A. The transfer switch shall be installed as shown on the plans, in accordance with the manufacture's recommendations and all applicable codes.
- B. The transfer switch

4.2 FACTORY TESTS

- A. The transfer switch manufacturer shall perform a complete functional test on the switch, controller and accessories prior to shipping from the factory. A certified test report shall be available upon request.

4.3 SERVICE

- A. The manufacturer shall maintain a national service organization that is factory trained and certified for transfer switch equipment. In addition, the service organization shall be available 24 hours per day, 365 days per year **within 100 miles of the project site.**

4.4 FACTORY WARRANTY

- A. The automatic transfer switch shall be warranted against defective workmanship for a period of two years, including both parts and labor.

END OF SECTION 263623

SECTION 265100 – 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.
- 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. Recessed luminaires shall have frames that are compatible with the ceiling systems.

C. 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_ANSI 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 luminaires and one at each end at opposite corners of 1' x 4' and 2' x 2' luminaires. 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. Anchor high intensity discharge luminaires mounted in ceiling or on wall to structure. Support recessed ceiling luminaires independent of ceiling construction. Supports to consist of 1/4" diameter bolts or rods.
- G. 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.
- H. 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.
- I. Provide plaster frames for recessed luminaires in plaster and concealed spline ceilings supported independent of ceiling construction with 1/4" rod anchored to structure.
- J. 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.
- K. 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.
- L. Connect luminaires in continuous rows other than recessed grid type connected by nipples with locknuts and bushings.
- M. Furnish complete manufacturers shop drawing for continuous luminaires showing mounting, ceiling interface and complete luminaire layout.

- N. 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.
- O. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- P. 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.

4.6 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.

END OF SECTION 265100

SECTION 265600 - 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. 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 all exterior lighting fixtures and poles with tags consistent with the University's standard naming convention. 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 and submitted to the Electric Shop.

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.

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: Provide in areas of consistent, high, uneven winds.

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 265600

SECTION 266000 – 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. Six copies of 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

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).

END OF SECTION 266000

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 51 13: Paging 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.
C.	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. 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.
- B. Spare conduits shall be plugged with expandable plugs.
- C. 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. Wire Cable Tray
 - 4. Pull Boxes
 - 5. Velcro Tie Wraps
 - 6. Cable Hangers (J-Hooks)
 - 7. Measuring Tape and Pull String
 - 8. Innerduct
 - 9. Fire Stop

1.2 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. 27 05 00: Common Work Results for Communications.
 - 2. 27 11 00: Communications Equipment Room Fittings
 - 3. 27 13 00: Communications Backbone Cabling
 - 4. 27 15 00: Communications Horizontal Cabling
 - 5. 27 51 13: Paging Systems
- 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 01 00 1.4 and in particular the following code requirements
 - 1. ANSI/TIA-568.0-E: Generic Telecommunications Cabling for Customer Premises (Revision E, March 2020).
 - 2. ANSI/TIA-568.1-E: Commercial Building Telecommunications Infrastructure Standard (Revision E, March 2020).
 - 3. ANSI/TIA-569-E: Telecommunications Pathways and Spaces (Revision E, May 2019)
 - 4. ANSI/TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises (Revision D, July 2019).
 - 5. ANSI/NFPA-70, 2017 -- National Electrical Code (NEC).
 - 6. Underwriter's Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

- A. All pathways and associated equipment shall be installed in a neat and workmanlike manner. Conduit, J-hooks, cable tray and pull boxes shall be installed and properly coordinated with other trades so that they are fully accessible for installation and pulling of cable. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative.

1.5 SUBMITTALS

- A. The Contractor shall provide product manufacturers data sheets for the following Items
 - 1. Cable Tray.
 - 2. Velcro tie wraps.
 - 3. Measuring tape / pull string.
 - 4. Innerduct.
 - 5. Firestop.
- B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.
- C. Shop drawings indicating the proposed layout and elevation of the following items shall be submitted for review and approval. Shop drawings shall be coordinated with the work of other trades.
 - 1. Cable tray.
 - 2. Conduit 2" and larger.
 - 3. Pull boxes.
 - 4. Main J-Hook runs.
 - 5. Sleeves.
- D. As-built drawings shall be submitted at the completion of the project showing the actual routing and location of the following items:

1. Cable Tray.
2. Conduit 2" and larger.
3. Pull boxes.
4. Sleeves
5. Main J-Hook runs.

PART 2 – PRODUCTS

2.1 CONDUITS

- A. See Electrical Specifications for additional raceway and j-box products and additional requirements.
- B. Install conduit where shown on the drawings.
- C. All backbone fiber and copper telecom cabling shall be installed in conduit.
- D. Conduit shall be routed concealed unless otherwise noted on the drawings.
- E. Install conduit for routing of horizontal telecom cabling where cable is routed through inaccessible areas including but not limited to walls, floors, chases, above gypboard or plaster ceilings, etc. Provide access doors as required to provide reasonable access for the installation of telecom cabling in inaccessible ceiling and wall spaces.
- F. Install conduit for routing of horizontal telecom cabling where cabling is routed in areas subsequent to damage including mechanical and electrical rooms.
- G. Install conduit for routing of horizontal telecom cabling in areas without ceilings or exposed to structure.
- H. 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.
- I. At each wall or ceiling mounted telecom outlet, the contractor shall install a 4 11/16" wide by 4 11/16" high by 2 1/2" 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.
- J. Where conduit penetrations are exposed in finished areas, install steel, chrome plated split ring escutcheon plates.
- K. 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. Yellow Zinc Dichromate finish meeting ASTM B633 SC2.
- 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. 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.
- G. 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.
- H. 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.
- I. Installed wire cable tray shall have rounded edges and smooth surfaces to prevent damage to cable jackets.
- J. Provide radius corners at all 90 degree bends, tees and crosses.
- K. 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. See the Electrical Specifications for acceptable products and additional requirements.
- D. 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.
- E. 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.
- F. 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.
- G. Provide separate sleeves for routing of CAT 6 and CAT 6A cabling.
- H. Install firestopping between the sleeve and structure, and between the telecom cables and the sleeve to maintain the wall rating.
- I. Where sleeve penetrations are exposed in an architectural finished area, install chrome plated steel split ring escutcheon plates.

2.4 PULL BOXES

- A. See the Electrical Specifications for additional pull box requirements and acceptable manufacturers.
- B. Provide pull boxes where shown on the drawings to accommodate copper backbone cable splices.

- C. Provide pull boxes in backbone cabling conduit every 100 feet and every 180 degrees of bend (whichever is the more strict provision) to facilitate pulling of backbone cabling.
- D. Pull boxes shall be sized so as not to exceed the minimum bend radius of the backbone fiber and copper cabling.
- E. Coordinate location of pull boxes with other trades. Provide access doors where required to access pull boxes in inaccessible wall or ceiling spaces.

2.5 CABLE HANGERS (J-HOOKS) AND SUPPORTS

- A. Provide cable hangers (J-hooks) spaced at 5'-0" centers to support horizontal cable from the workstation outlet to the cable tray.
- B. Hangers shall be prefabricated, zinc coated, carbon steel hangers designed specifically for 4-pair UTP communications cabling installations.
- C. Hangers shall have an open top and rolled edges. Hangers shall have a minimum 2" and maximum 4" diameter loop.
- D. Hangers shall be supported directly from the building structure. The Contractor shall provide anchors, beam clamps, threaded rod, rod fasteners, flange clips and brackets as needed to support the cable hangers from the building structure. Do not attach hangers to ceiling support wires or other support systems installed by other building trades.
- E. J-hooks shall not support more cables than recommended by the manufacturer. J-hooks shall be sized to provide a minimum 20 percent spare capacity.
- F. Cable bundles shall not exceed (24) cables and shall be loosely bound with Velcro cable straps.
- G. Acceptable Products
 - 1. Erico Caddy CableCat Clips.
 - 2. B-Line Cable Hook System.
 - 3. Panduit J-Pro Cable Support System.
 - 4. Or approved equal.

2.6 VELCRO CABLE STRAPS

- A. Install Velcro cable ties cut to length from a continuous roll to loosely bundle horizontal cabling routed down J-hook lines, on the cable tray and ladder rack.
- B. Install Velcro cable ties at 2'-0" intervals outside of the telecom room and 1'-0" intervals inside the telecom room.
- C. Do not exceed qty (24) cables per bundle.
- D. Provide plenum rated Velcro tie wraps where cable is routed in plenum spaces.

E. The use of plastic tie-wraps to bundle cabling is not permitted.

F. Acceptable Products

1. Panduit HLS-15R6 or HLSP (plenum rated).
2. Leviton 43115-075.
3. Or approved equal.

2.7 MEASURING TAPE AND PULL STRING

A. Install pull string in all telecom conduit and innerduct. Pull string shall be ½" pre-lubricated high strength woven polyester with sequential foot markings. The tensile strength of the pull string shall be greater than or equal to 1,250 lbs.

B. Pull string shall meet or exceed the requirements of Bellcore GR-356-CORE "Generic Requirements for Optical Cable Innerduct and Accessories".

C. Acceptable Products

1. Carlon TL145xx.
2. A-D Technologies Bull-Line WP12xx.
3. Or approved equal.

2.8 INNERDUCT

A. Provide multi-cell fabric innerduct where shown on the drawings and for installation of backbone fiber and copper cabling.

B. Innerduct should be terminated at the conduit entrance in the telecom rooms and secured to the plywood backboard.

C. Provide fabric innerduct size and cell count as shown on the drawings.

D. Acceptable Products

1. Maxcell Fabric Innerduct
2. No Known Equal.

2.9 FIRE STOPPING

A. Provide fire stopping and backing material between sleeves/conduit penetrations through rated partitions or floors. Provide fire stopping in sleeves/conduits after all cables have been installed.

B. The minimum required fire resistance ratings of the wall or 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 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.

3.2 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.

3.3 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.

3.4 SLEEVES

- A. Install sleeves through walls and floors as required to route horizontal and backbone telecom cabling.
- B. Firestop all penetrations through rated or acoustical walls. Firestop assemblies shall meet or exceed the rating of the walls or floors being penetrated.
- C. Coordinate layout and installation of concrete wall and floor sleeves prior to concrete pours. Contractor is responsible for providing, installing, securing and covering sleeves. The contractor shall have field personnel on site during concrete pours to ensure that sleeves are not dislodged or moved during concrete pours. Contractor will be responsible for core drilling costs related to missed or improperly located sleeves.
- D. 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.
- E. Where sleeves are installed more than 24" above the overhead ladder rack in the telecom rooms, install wall mounted vertical ladder rack below the sleeves to support cabling.
- F. Provide separate sleeves for routing of CAT 6 and CAT 6A cabling.

3.5 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.

3.6 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 Concrete Hand Holes and Covers 10" Wide x 17" Long (Non Traffic Rated).
 - 3. Precast Concrete Hand Holes and Covers 13" Wide X 24" Long (Non Traffic Rated).
 - 4. Precast Concrete Pull Boxes and Covers 17" Wide X 30" Long (Non Traffic Rated).
 - 5. Precast Concrete Pull Boxes and Covers 17" Wide X 30" Long (H-20 Traffic Rated).
 - 6. Precast Concrete Pull Boxes and Covers 30" Wide X 48" Long (Incidental H-20 Traffic Rated).
 - 7. Precast Concrete Pull Boxes and Covers 36" Wide X 60" Long (H-20 Traffic Rated).
 - 8. Multi-cell fabric innerduct.
 - 9. Pull rope.
 - 10. 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 01 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 Concrete Hand Holes and Covers 10" Wide x 17" Long (Non Traffic Rated).
 - 3. Precast Concrete Hand Holes and Covers 13" Wide X 24" Long (Non Traffic Rated).
 - 4. Precast Concrete Pull Boxes and Covers 17" Wide X 30" Long (Non Traffic Rated).
 - 5. Precast Concrete Pull Boxes and Covers 17" Wide X 30" Long (H-20 Traffic Rated).
 - 6. Precast Concrete Pull Boxes and Covers 30" Wide X 48" Long (Incidental H-20 Traffic Rated).
 - 7. Multi-cell fabric innerduct.
 - 8. 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. Certaineed 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 IDF.

- B. Provide qty (1) 2" 3-Cell MaxCell fabric innerduct "packs" in each 2" conduit between the MDF and the IDF's.
- C. The MaxCell innerduct shall be terminated at the entry point of the telecom rooms and secured to the plywood backboard. 1 1/4" non-split orange corrugated innerduct shall be installed to route fiber optic backbone cabling from this point to the fiber termination cabinet(s).
- D. Acceptable Products:
 - 1. MaxCell Edge 2" 3-Cell Part Number MXE52223xx1000 (for installation in 2" conduits).
 - 2. No Substitutions accepted.

2.4 PULL ROPE

- A. Pull rope shall be installed within each outside plant conduit and within each innerduct.
- B. Pull rope 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 pull rope with sequential foot markings.

2.1 TELECOM HAND HOLES AND COVERS (10" WIDE X 17" LONG) NON-TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.
- B. Provide 10" wide x 17" long x 12" deep reinforced concrete pull box.
- C. Provide qty (2) 10" wide x 17" long x 12" deep reinforced concrete extensions.
- D. Provide reinforced concrete lockable bolt down lid.
- E. Provide additional reinforced concrete extensions as required to maintain conduit depth as shown on the drawings.
- F. Acceptable Products:
 - 1. Jensen Precast HN1017-B pull box, HN1017-E Extension and HN1017-L01 Lid.
 - 2. Or Approved Equal.

2.2 TELECOM HAND HOLES AND COVERS (13" WIDE X 24" LONG) NON-TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.

- B. Provide 13" wide x 24" long x 12" deep reinforced concrete pull box.
- C. Provide qty (2) 13" wide x 24" long x 12" deep reinforced concrete extensions.
- D. Provide reinforced concrete lid.
- E. Provide additional reinforced concrete extensions as required to maintain conduit depth as shown on the drawings.
- F. Acceptable Products:
 - 1. Jensen Precast HN1324 pull box, HN1324-E extension and HN1324-L02 Lid.
 - 2. Or Approved Equal.

2.3 TELECOM PULL BOXES AND COVERS (17" WIDE X 30" LONG) NON-TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.
- B. Provide 17" wide x 30" long x 12" deep reinforced concrete pull box.
- C. Provide qty (2) 17" wide x 30" long x 12" deep reinforced concrete extensions.
- D. Provide reinforced concrete lockable bolt down lid.
- E. Provide additional reinforced concrete extensions as required to maintain conduit depth as shown on the drawings.
- F. Acceptable Products:
 - 1. Jensen Precast HN1730-B pull box, HN1730-E extension and HN1730-L01 Lid.
 - 2. Or Approved Equal.

2.4 TELECOM PULL BOXES AND COVERS (17" WIDE X 30" LONG) H-20 TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.
- B. Pull boxes, risers and lids shall be H-20 traffic rated.
- C. Provide 17" wide x 30" long x 12" deep reinforced concrete pull box.
- D. Provide 17" wide x 30" long x 12" deep reinforced concrete extensions.
- E. Provide steel diamond plate bolt down lid.

- F. Provide additional reinforced concrete risers as required to maintain conduit depth as shown on the drawings.
- G. Acceptable Products:
 - 1. Jensen Precast HT1730-B pull box, HT1730-E extension and HT1730-L-11-01 Lid.
 - 2. Or Approved Equal.

2.5 TELECOM INTERCEPT PULL BOXES AND COVERS (30" WIDE X 48" LONG)
INCIDENTAL H-20 TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.
- B. Provide 30" wide x 48" long x 30" deep reinforced concrete intercept pull box with 4" deep base.
- C. Provide 30" wide x 48" long x 12" deep reinforced concrete riser.
- D. Provide split incidental H-20 steel bolt down diamond plate surface. Covers shall be labeled "COMMUNICATIONS".
- E. Provide corrosion resistant galvanized steel channel racking and cable support hooks in all pull boxes. Racking and cable support hooks shall be installed on both sides of each pull box.
- F. Acceptable Products:
 - 1. Jensen Precast PB3048-I intercept pull box (PB3048-I), 12" Riser RS304812 and incidental H-20 Cover CA3048C61.
 - 2. Or Approved Equal.

PART 3 – EXECUTION

3.1 UTILITY COORDINATION

- A. Contact local utility companies and utility locating services prior to excavation to locate and mark existing underground utilities.
- B. Coordinate conduit routing with existing underground utilities. Reroute conduit and provide horizontal and vertical offsets as required to avoid and to provide necessary clearances from existing utilities.

3.2 CONDUIT

- A. OSP conduits shall be installed with a slight drain slope (0.125 inches-per-foot) away from buildings to prevent the accumulation of water in the conduit or ingress to the buildings.
- B. Factory-manufactured sweeps which meet ANSI/TIA-569-B bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable.
- C. Any 4" conduit with a sweep of more than 11 degrees is to have a minimum concrete encasement of 4".
- D. OSP conduits shall be installed a minimum of 48" below finished grade. Conduits shall be encased in hard-tamped sand a minimum of 6" above and below the conduits. 6" clear space shall be maintained between conduits. Backfill above the conduits shall be installed and compacted to 95% density.
- E. OSP conduit and duct bank runs must have a continuous orange colored, metal detectable warning tape installed half the distance between the top of the conduit and the finished grade.
- F. All cable shall be installed in the lowest available conduit in a duct bank, working up as additional cables are installed.
- G. Prior to installing cables, all new or unused OSP conduits must be cleaned with a brush pulled through the conduit at least two times in the same direction and swabbed with clean rags until the rag comes out of the conduit clean and dry. Conduits shall then be tested with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run.
- H. Spare OSP conduits and innerducts shall be plugged with watertight plugs at both ends to prevent the intrusion of moisture, gasses, and rodents throughout the construction project.
- I. All OSP conduits and innerduct shall have a 3/8" nylon pull rope installed. Pull rope shall be re-pulled each time an additional cable is installed.

3.3 PULL BOXES

- A. Install pull boxes and set covers to match finished grade.
- B. Conduits shall enter pull boxes from the side. Do not sweep conduits into the bottom of the pull box.

3.4 CUTTING AND PATCHING

- A. Sawcut and remove existing pavement, sidewalks, gutters, etc., to accommodate installation of outside plant conduit and pull boxes.

- B. Replace sub-base, pavement, sidewalks gutters, etc., to match existing.
- C. Repair and replace all landscaping and sitework disturbed by excavation including but not limited to irrigation lines, lawns, planting, etc. Resod lawn areas disturbed by excavation.

END OF SECTION 270543

SECTION 270800 – COMMISSIONING OF COMMUNICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the testing, labeling and documentation of the telecom cabling system in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.
- C. This section includes the minimum requirements for the testing, identification and administration for the telecommunications cabling system, including the following:
 - 1. Testing
 - a. Category 6 Cable Test Equipment and Test Procedures.
 - b. Category 6A Cable Test Equipment and Test Procedures.
 - c. Copper backbone cable test equipment and test procedures.
 - d. Fiber optic cable test equipment and test procedures.
 - e. Cable test reports.
 - 2. Identification
 - a. Labeling of work area outlet faceplates and jacks.
 - b. Labeling of horizontal data, voice and video cabling.
 - c. Labeling of Copper Patch Panels.
 - d. Labeling of fiber optic patch panels.
 - e. Labeling of 110 wiring blocks.
 - f. Labeling of racks and cabinets.
 - g. Labeling of copper and fiber backbone cable.
 - h. Labeling of innerduct.
 - 3. Administration
 - a. As-built drawings.
 - b. Materials listing.

1.2 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. 27 05 00: Common Work Results for Communications.
 - 2. 27 11 00: Communications Equipment Room Fittings
 - 3. 27 13 00: Communications Backbone Cabling

4. 27 15 00: Communications Horizontal Cabling

- 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 01 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. 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. Cable tester shall comply with the requirements of ANSI/TIA-1152.
- B. Cable tester shall perform all tests necessary to certify the horizontal Category 6 UTP cabling in accordance with ANSI/TIA 568 C.2.
- C. 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.
- D. Acceptable Manufacturers
 - 1. Fluke Networks
 - 2. Ideal Industries
 - 3. Agilent Wirescope
 - 4. AEM
 - 5. Softing/WireXpert
 - 6. Trend Networks.
 - 7. Or equal.

2.2 CATEGORY 6A (AUGMENTED) UNSHIELDED TWISTED-PAIR CABLE TESTER

- A. Cable tester shall comply with the requirements of ANSI/TIA-1152.
- B. Cable tester shall perform all copper UTP Cat 6A CMP-rated cable with tester set-up to identify the cable manufacturer with associated NVP as well as the connectivity manufacturer.
- C. Shall be a UL certified Level IIIe test set calibrated by a manufacturer certified calibration facility.
- D. The software calibration date shall be current throughout the testing phase of the project and be stated in the test results documentation or, by hard copy from the manufacturer.
- E. The tester set-up should include the application to support 10GBase-T (IEEE 802.3an).
- F. Test results shall be in PDF format and, if requested, manufacturer proprietary software.
- G. Acceptable Manufacturers
 - 1. Fluke Networks
 - 2. Ideal Industries
 - 3. Agilent Wirescope
 - 4. AEM
 - 5. Softing/WireXpert
 - 6. Trend Networks.

7. Or equal.

2.3 SINGLEMODE OPTICAL FIBER CABLE TESTER

- A. Tier 1 certification is defined as the measurement of the total insertion loss, length, and polarity of the optical cable cabling from one end of the link to the other. The test equipment used is a 'combined' optical power meter and light source called an OLTS or Optical Loss Test Set.
- B. Test Reference Cables (TRCs) minimum standards; 2.8-3.0 OD jacketing, zirconia ceramic UPC LC ferrule < 0.25 dB IL (insertion loss) and > 0.50 RL (reflection loss).
- C. Tier 2 optical fiber testing includes Tier 1 OLTS testing and is used to define the graphical precise characterization of the fiber link. The tester used for Tier 2 testing is an OTDR or Optical Time Domain Reflectometer.
- D. When using an OTDR, use only high-quality, low-loss, dual launch boxes having the same optical cable and connectors being tested and are required at both transmit and receiving ends.
- E. Both Tier 1 and Tier 2 testing shall be bi-directional and dual wavelengths (1310 & 1550 nm).
- F. The tester shall be capable of performing the tests required by ANSI/TIA-568.1-E, ANSI/TIA-568.3-D, ANSI/TIA-526-7A and TR 42.11.
- G. The software calibration date shall be current throughout the testing phase of the project and be stated in the test results documentation or by hard copy from the manufacturer.
- H. The tester set-up should include the application to support QSFP28-100GBase-LR4 (IEEE 802.3 bm).
- I. Acceptable Manufacturers
 1. Agilent Wirescope
 2. AEM
 3. AFL
 4. EXFO
 5. FIS
 6. Fluke Networks
 7. Fujikura
 8. Ideal Industries
 9. Jonard
 10. Softing/WireXpert
 11. VIAVI
 12. Or equal.

2.4 LABELS

- A. Labels shall be laser printed and shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- B. Acceptable manufacturers
 - 1. Belden
 - 2. Brady
 - 3. Brother
 - 4. HellermannTyton.
 - 5. Or approved equal

2.5 WORK AREA OUTLET FACEPLATE LABELS

- A. Label each port in each faceplate in accordance with Labeling Scheme identified on the Drawings. Label must be machine printed and inserted in the faceplate label window. Labels shall be provided by the faceplate manufacturer of the faceplate.
- B. Acceptable manufacturers
 - 1. Belden
 - 2. Brother
 - 3. HellermannTyton.
 - 4. No Substitution

2.6 HORIZONTAL CABLE SHEATH LABELS

- A. Label horizontal cable sheaths at work area outlets and at patch panels with laser printed self-laminating wrap around vinyl labels. Labels shall be in accordance with the Labeling Scheme identified in WCSD SCS-015.
- B. Labels shall be white with black type. Label size shall be 1.0" wide by 1.5" high.
- C. At the Telecom Room, cable labels will be affixed to cable a minimum of 1 inch from the termination on the patch panel, and placed in such a way as to be clearly visible.
- D. At the work area outlet, cable labels shall be affixed to the cable 2 inches from the termination on the jack.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

2.7 COPPER PATCH PANEL LABELS.

- A. Label each patch panel with a single panel ID label in accordance with the labeling scheme identified WCSD SCS-015.

- B. Labels shall be compatible with the patch panels provided for the Project.
- C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal
- D. Label each patch panel port with a laser printed label. Label each port with the room number of the room housing the work area outlet.
- E. Labels shall be compatible with the patch panels provided for the Project.
- F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.375" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

2.8 TELECOM ROOM FIBER OPTIC TERMINATION CABINET LABELS

- A. Label each fiber optic patch panel with a single panel ID label in accordance with the labeling scheme identified WCSD SCS-015.
- B. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal
- C. A label will be affixed to the fiber termination cabinet as shown using the Backbone Cable Labeling Scheme.
- D. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.

- e. Or approved equal

2.9 EQUIPMENT ROOM FIBER OPTIC TERMINATION CABINET LABELS

- A. Label each fiber termination cabinets in accordance with the labeling scheme identified in WCSD-SCS-015.
- B. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal
- C. Label fiber modules in accordance with the labeling scheme identified in WCSD-SCS-015. Labels shall be affixed to the fiber termination cabinet directly on the Plexiglas front cover so labels will be visible when the cover is closed. Each label will indicate the exact location and position of the cable's far end according to the Backbone Cable Labeling Scheme.
- D. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal
- E. Label each Connector Module with its Slot in accordance with the labeling scheme identified on the drawings.
- F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

2.10 EQUIPMENT RACK LABELS

- A. Provide labels on the top angle of all equipment racks. Labels shall in accordance with the labeling scheme identified in WCSD-SCS-015.
- B. Racks shall be labeled with Space ID and Rack ID.

- C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 1.0" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

2.11 COPPER BACKBONE CABLE SHEATH LABELS

- A. The backbone cable sheaths in the Telecom rooms and at pull boxes shall be labeled. Labels shall be in accordance with the labeling scheme identified in WCSD-SCS-015.
- B. Labels must be clearly visible at the rear of the rack.
- C. Labels shall be self-laminating vinyl labels and must be compatible with the diameter of the backbone cable. Labels shall be 2.5" high by 1.5" wide.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

PART 3 – EXECUTION

3.1 CABLE TESTING – GENERAL

- A. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
- B. Where post-manufacture test data has been provided by the manufacturer on the reel or shipping carton, submit copies to the Owner's Representative as part of the cable test results.
- C. The Owner's Representative reserves the right to observe any or all portions of the cable testing process.
- D. The Owner's Representative further reserves the right to conduct, using contractors equipment and labor, a random re-test of up to ten percent (10%) of the cable plant to confirm documented test results.
- E. Test results and corrective procedures are to be documented and submitted to the Owner's Representative within five (5) working days of test completion.

3.2 CATEGORY 6 UTP CABLE TESTING

- A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.
- B. Field test measurements shall be made in accordance with Annex I of TIA 568-C.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 ANSI/TIA-1152. 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 TIA 568-C.2 Annex C: "Cabling and Component Test Procedures".
- 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 TIA 568-C.2 Section 6.3.
- 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-C.2; 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 ANSI/TIA-568-C.2.
- C. Field test measurements shall be conducted from 1 MHz to 500 MHz.
- D. Field testing shall be conducted using a level IIIe tester. The accuracy of the level IIIe tester shall meet or exceed the requirements of ANSI/TIA-1152.
- E. The software calibration date shall be current throughout the testing phase of the project and be stated in the test results documentation or, by hard copy from the manufacturer.
- F. Every cabling link shall be tested to copper 100-ohm UTP Cat 6A cable with tester set-up to identify the cable manufacturer with associated NVP as well as the connectivity manufacturer.
- G. The cable must be tested to "Permanent Link" performance as defined in ANSI/TIA 568.2-D having a maximum length of 295 feet (90m).
- H. 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.

- I. 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).
- J. 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.
- K. 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
 - 2. Length
 - 3. Propagation Delay
 - 4. Delay Skew
 - 5. DC Loop Resistance
 - 6. Insertion Loss
 - 7. NEXT (Near-End Crosstalk)
 - 8. PS NEXT (Power Sum Near-End Crosstalk)
 - 9. ACR-N (Attenuation to Crosstalk Ratio Near-End)
 - 10. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
 - 11. ACR-F (Attenuation to Crosstalk Ratio Far-End)
 - 12. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
 - 13. Return Loss
- L. Test results shall be provided in electronic PDF and raw data format within 5 days after the completion of the project. Test documentation shall be saved in Fluke LinkWare file format version 11.0 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).
 - g. Date and time.
 - 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. 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.
4. 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. Once corrective measures have been taken and the failed tests passes, only retain the PASS test and discard the FAIL for final documentation.

3.4 SINGLEMODE 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 fiber strands shall be tested and must pass the field test specifications defined by the Telecommunications Industry Association (TIA) standards ANSI/TIA-568.1-E, ANSI/TIA-568.3-D and ANSI/TIA-526-7-A. Any failing fiber strands 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-526-7A. The light source shall meet the launch requirements of ANSI/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-568-1-E) with a Category 1 light source. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/TIA-526-7-A.

- 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. Test Reference Cables (TRCs) minimum standards; 2.8-3.0 OD jacketing, zirconia ceramic UPC LC ferrule < 0.25 dB IL (insertion loss) and >0.50 RL (reflection loss).
- 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. Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA-526-7-A, Method A.1, One Reference Jumper or equivalent method.
 - 2. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA-568.3-D.

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:

Wavelength	OSI (ISP)	OS1A (ISP OS2)	OS2 (OSP)
1310 nm	1.0 dB/km	0.4 dB/km	0.4 dB/km
1310 nm	0.3 dB/Mft	0.12 db/Mft	0.12 dB/Mft
1550 nm	1.0 dB/km	0.4 dB/km	0.4 dB/km
1550 nm	0.3 dB/Mft	0.12 db/Mft	0.12 dB/Mft

- 3. Maximum insertion loss (IL) per mated pair is 0.35 dB and 0.02 dB per fusion (only) splice.

- I. The Contractor shall test all fiber optic cables and provide test results in electronic PDF format signed by the technician performing the testing. The following field test documentation shall be provided for each fiber optic strand:
 1. Wavelength of test (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.

3.5 IDENTIFICATION AND LABELING

- A. The Contractor shall confirm the telecom room and work area room numbers with the Owner or Owner's Representative prior to labeling.
- B. Labeling scheme shall follow the requirements of Washoe County School District Structured Cabling Specification WCSD-SCS-015 dated October 21, 2016.
- C. Work Area Outlet Face Plates: See WCSD-SCS-015 for requirements.
- D. Work Area Data and Voice Jacks: See WCSD-SCS-015 for requirements.
- E. Work Area Horizontal Data, Voice and Video Cable: See WCSD-SCS-015 for requirements.
- F. Telecom Room Horizontal Data, Voice and Video Cable: See WCSD-SCS-015 for requirements.
- G. Patch Panels: See WCSD-SCS-015 for requirements.
- H. Patch Panel Ports: See WCSD-SCS-015 for requirements.
- I. Fiber Termination Cabinets: See WCSD-SCS-015 for requirements.
- J. 110 Blocks: See WCSD-SCS-015 for requirements.
- K. Backbone Cables: See WCSD-SCS-015 for requirements.
- L. Equipment Racks and Cabinets: See WCSD-SCS-015 for requirements.

3.6 ADMINISTRATION

A. As-Built Drawings.

1. The Contractor shall provide As-Built drawings at the end of the project in electronic PDF format. 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
 - 18. Wall Mounted Telecom Cabinets (Small TE).
 - 19. Outdoor Pole Mounted NEMA 4X Telecom Cabinet

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 Quad rack 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 3/4" 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 3/4" 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	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

- 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:
 - 2.
 - 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 1/2" 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 1/2" 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 1/4" 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 1/4" 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 1/4" and on 3/4" 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.

2.18 WALL MOUNTED TELECOM ENCLOSURES (SMALL TE)

- A. Provide wall mounted telecom enclosures where shown on the drawings.
- B. Enclosures shall be secured to wall with minimum qty (4) lag bolts.
- C. Enclosures shall be UL Listed with black powder coat finish.
- D. Acceptable Products (provide all of the following part numbers):
 - 1. Enclosure: Chatsworth P/N 13050-223.
 - 2. Fan Kit: Chatsworth P/N 13051-001.
 - 3. Horizontal Cable Manager: Chatsworth P/N AO403977.
 - 4. Filler panel: Chatsworth P/N 30024-701.
 - 5. Line Thermostat: Dayton P/N 4LZ94.
 - 6. Fiber Enclosure: Belden P/N AO643207.
 - 7. Fiber Singlemode LC Adapter: Belden P/N AX102215.
 - 8. 48-port CAT 6A patch panel: Belden P/N RVAPPF2U48BK.
 - 9. Keyconnect side entry box (Belden P/N AX102652).
 - 10. No substitutions.

2.19 OUTDOOR POLE MOUNTED NEMA 4X NETWORK EQUIPMENT CABINET

- A. Furnish and install pole mounted network equipment cabinets where shown on the drawings. Cabinets shall meet the following physical specifications:
 - 1. UL Listed.
 - 2. NEMA 4X rating.
 - 3. Approximate dimensions 21" high x 24" wide x 24" deep.
 - 4. Qty (9) 19" rack mounting spaces (9 RU).
 - 5. Outdoor pole mount enclosure with solid lockable front door.
 - 6. 3-point locking system. Stainless steel door hardware / hinge.
 - 7. Top solar shield.
 - 8. Heavy duty outdoor 0.125" minimum aluminum construction.
 - 9. 1-pair L shaped 19" EIA mounting rails w/#12-24 mounting screws.
 - 10. Outdoor pole mounting "C" channels.
 - 11. 15-year warranty.
- B. Secure cabinets to light poles with stainless steel mounting hardware.
- C. Acceptable Products:

1. DDB Unlimited SOD-192420 (NEMA 4X Rated).
2. Or Approved Equal.

PART 3 – EXECUTION

3.1 TELECOM EQUIPMENT ROOM COORDINATION

- A. The electrical and telecom contractors are responsible for coordinating the installation of all equipment and cabling pathways located within the telecom rooms.
- B. The electrical and telecom contractors shall coordinate the work of all other trades that have work located within the telecom equipment rooms.
- C. The electrical and telecom contractors shall create and submit for approval coordinated scaled shop drawings of the telecom room showing the proposed location of all work. Shop drawings shall be submitted and approved prior to installing any work in the telecom rooms.

3.2 UTILITIES INSTALLED AND ROUTED THROUGH COMMUNICATION ROOMS

- A. Telecom rooms are dedicated for the installation and support of telecom and security related equipment. Other equipment and utilities not specifically dedicated to the support of the telecom room are not permitted. This includes the telecom room and the space above the finished ceiling (where occurs) to the structure above. The following items are permitted:
 1. Telecom and security related equipment and cabling.
 2. Electrical panels, electrical outlets and uninterruptable power supplies directly serving equipment within the telecom room.
 3. Electrical lighting and switches directly serving the telecom room.
 4. HVAC ductwork, AC units, fan coil units and piping directly serving the telecom room.
 5. Sprinkler piping directly serving sprinkler heads located in the telecom room.
 6. Fire protection devices including smoke detectors and heat detectors directly serving the telecom room.
- B. The following items are not permitted to be installed or routed through the telecom equipment rooms:
 1. Electrical panels, transformers, feeders and/or conduit not specifically dedicated to the telecom room.
 2. Fire alarm panels (unless specifically shown on the drawings or approved by the Owner's representative).
 3. HVAC ductwork, fan coil units, chilled water piping, heating hot water piping, and/or control panels not specifically dedicated to the telecom room.

- 4. Plumbing piping including cold water piping, hot water piping, condensate piping, waste piping and/or drain piping not specifically dedicated to the support of the telecom room.
- C. Any utilities routed through a telecom equipment room that do not directly serve the room must be rerouted and/or relocated at the contractor's expense.
- D. Any equipment located in the telecom equipment rooms not directly serving the room shall be relocated at the Contractor's expense.
- E. Any utilities within a telecom room that pose a leak hazard to the equipment located within the room (with the exception of dedicated sprinkler piping) shall have a drip pan and appropriate drain piping installed to mitigate the leak risk.

3.3 FLOOR MOUNTED RACKS

- A. Floor mounted racks and cabinets shall be secured to structure with a minimum of (4) 1/2" diameter concrete expansion anchors or as required by local codes.
- B. Racks and cabinets shall be placed with a minimum of 36" clearance from the walls on at least three sides (two of which must be front and rear) of the rack. When mounted in a row, maintain a minimum of 36" from the wall behind and in front of the row of racks and from the wall to at least one end of the row.
- C. All racks, free-standing cabinets, and wall-mount cabinets shall be bonded to the ground bar in each room with a separate #6 green insulated grounding conductor.
- D. Rack mount cage nuts/screws not used for installing patch panels and other hardware shall be bagged and left with the rack or cabinet upon completion of the installation.

3.4 PLYWOOD BACKBOARDS

- A. Mechanically fasten fire treated plywood sheets to the walls.
- B. Install plywood on all 4 walls of the telecom room unless specifically noted otherwise on the drawings.
- C. Run plywood sheets vertically from 6" AFF to 8'-6" AFF.
- D. Where plywood will support backbone cabling, secure plywood to wall with sufficient fasteners to support 1,500 pounds of weight.
- E. Paint plywood with 2 coats of white paint. Mask fire treatment labels on plywood prior to painting.

3.5 HORIZONTAL CABLE PATHWAY

- A. Should vertical or horizontal clearances not be possible due to physical constraints of the designated space, the Contractor shall immediately contact the Owner's Representative for alternative routing.
- 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 fusion splice cassettes.
- 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

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
- B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.
- C. Submit all factory test information of cables prior to installation of the product.

1.6 DELIVERY, STORAGE & HANDLING

- A. Visually examine cable spools and boxes for damage after delivery to the jobsite prior to installation. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.7 GUARANTEE

- A. The outside plant (OSP) and premise fiber optic cabling system including fiber termination cabinets, fiber connectors, fiber optic patch cords, etc. shall be covered by a 25-year system warranty from Belden/CDT.

PART 2 – PRODUCTS

2.1 SINGLEMODE TIGHT BUFFERED FIBER OPTIC CABLING – INDOOR/OUTDOOR

- A. Provide cables with fiber strand counts as shown on the drawings.
- B. Fiber optic cable shall be indoor/outdoor rated suitable for underground duct installation.
- C. Fiber Optic cabling shall have a riser rated jacket (OFNR).
- D. Fiber optic cables shall be tight buffered with a black colored jacket.
- E. Maximum attenuation characteristics
 - 1. Maximum attenuation 0.80/0.50 dB/Km @ 1310/1550 nm.
- F. Physical Characteristics
 - 1. Cable will have 900 µm buffer with mechanically strippable PVC jacket.
 - 2. The designation "UL" and "OFNR" shall be printed on the jacket with length markings every 2'-0".
 - 3. The cable shall have individual fiber tube colors per TIA/EIA-606 and overall yellow jacket.
 - 4. The cable shall contain an aramid yarn strength member with cables stranded around center.
 - 5. The cable shall be suitable for operating temperatures of -40° to +70° 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 SINGLEMODE LC CONNECTORS

- A. Terminate single mode cable on fusion splice on LC connectors (see rack elevations).
- B. Acceptable Products:
 - 1. Belden/CDT P/N FTSLC900FS01.
 - 2. No Substitutions.

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 – 568-B.1 Section 10.3.2.

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
 9. OSP CAT 6 Cable (For Parking Lot Pole Mounted Cameras)

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
 - 8. OSP CAT 6 Cable (For Parking Lot Pole Mounted Cameras)
- 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 Conduct or Cable Insertion Loss (dB)	NEXT Loss (dB)	PSNEX T 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 gym 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.

2.2 HORIZONTAL CATEGORY 6 CABLE - OUTSIDE PLANT

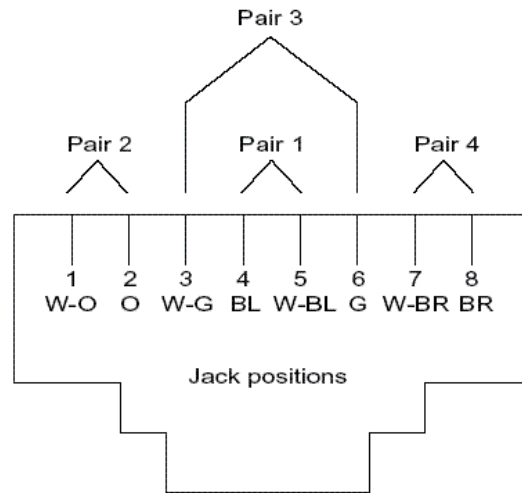
- A. Provide 4-pair CAT 6 OSP rated cabling.
- B. Cables shall be filled and flooded with a water-blocking compound. The cable shall consist of 4-pair 24 AWG insulated conductors. Cable shall be suitable for underground duct installation.
- C. Cable jacket marking: Must be legible and shall contain the following information:
 - 1. Manufacturer's name.
 - 2. Copper conductor gauge.
 - 3. Pair count.
 - 4. Manufacturer's trade mark.
 - 5. Sequential foot markings.
- D. Acceptable Products:
 - 1. Belden P/N OSP6u 01010000.
 - 2. No substitutions.

PART 3 – EXECUTION

3.1 HORIZONTAL CABLE ROUTING AND TERMINATION

- A. 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.
- B. 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.

- C. Category 6 and Category 6A cables shall be bundled separately.
- D. 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.
- E. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturers requirements and reference documents.
- F. 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.
- G. All telecom cables shall be stored in accordance with the manufacturer's requirements.
- H. 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.
- I. 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.
- J. 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.
- K. 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).
- L. Horizontal UTP pair untwist at the termination shall not exceed 0.5".
- M. 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:



- N. 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.
- O. 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.
- P. 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.
- Q. 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.
- R. When placing cable, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).
 - 1. 6" clear from power conductors.
 - 2. 12" clear from fluorescent lighting fixtures and ballasts.
 - 3. 36" clear from transformers and motors.

3.2 WORK AREA OUTLETS

- A. Work Area outlets and connectors shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer's recommendations and best industry practices.
- C. Pair untwist at the termination shall not exceed 0.5".
- D. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.

END OF SECTION 271500

SECTION 275113 – PAGING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY OF WORK

- A. This section includes a fully operational IP platform for a facility-wide internal communications:
 - 1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.
 - a. Emergency announcements that will override any pre-programmed audio.
 - b. District-wide, Emergency, Group, All School and Zone live voice paging.
 - c. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music and voice.
 - d. Web-based user interface.
 - 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 facility directly via the School District supplied SIP enabled Telephone Network.
 - 4. 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.
 - 5. Paging and two-way intercom features shall be accessible from any system console or SIP connected telephone for each campus.
 - 6. The platform shall synchronize its system time to the network timeserver or a web-based time server.
 - 7. Each single campus installation shall be locally survivable for intercom, paging, even when the district connection is unavailable.
 - 8. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.
 - 9. 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

- 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 announce 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. Visual Status Indicator Lights
1. Visual status indicator lights shall be provided at locations shown on the drawings. Lights shall have multi-color status lights and shall be programmed to display colors associated with an initiated "code" event.
- H. Equipment Racks
1. Where shown on the drawings, equipment shall be rack mounted in 4-post telecom racks (see telecom drawings).
 2. Provide dedicated paging system equipment racks where shown on the drawings.
- I. 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.

J. 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.

K. 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 have a mar/scratch baked epoxy rust inhibitive finish.

L. 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 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 1/2" diameter plenum rated coax antenna distribution cabling and related raceway, boxes, supports, connectors, splitters 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 splitters, 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, splitters 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 splitters and directional couplers to balance the RF signal strength at each antenna throughout the building.

Submit proposed cable splitters 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 & 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 tiles | Space above a ceiling constructed of removable (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. The Contractor shall seal all building penetrations to prevent the intrusion of moisture.

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

280500 - 2 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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 280500

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 & Security.
 - 2. Section 28 10 00: Access Control.
 - 3. Section 28 20 00: Video Surveillance.
 - 4. 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. 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 280528 - 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 on the exterior of the building and 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. Paint exposed conduit.

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.
- C. Minimum conduit size of 3/4 inch, but not less than the size shown on the drawings.
- D. All conduit ends shall be equipped with insulated bushings.
- E. All four inch conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.
- F. 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.
- G. 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.
- H. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- I. 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.
- J. 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
$\frac{3}{4}$	(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)

- K. Furnish and install 3/4 inch thick fire retardant plywood specified in on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 6 inches above the finished floor.
- L. 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 280528

SECTION 280553 - IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 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.

1.2 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 10 00: Access Control.
 - 4. Section 28 20 00: Video Surveillance.
 - 5. 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:
 - 6. National Electric Code (NEC), NFPA 70.

1.4 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

2.1 LABELS

A. Phenolic two tone for exterior mounting on equipment enclosures. White lettering on black background.

2.2 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

3.1 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 281000 - 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 manual push button door release where shown.
- F. Prep existing door frames to receive access control devices.
- G. 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.
- H. Furnish, install, terminate and label signal and power cabling for all door access control devices.
- I. Furnish and install end-to-end raceway system for access control cabling.

- J. Furnish and install Category 6 network cabling to the POE+ 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.
- K. Configure existing access control system head-end software and licensing to integrate access control system installed at the school.
- L. Assign group security accounts to local door controllers as directed by WCSD.
- M. 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.
- N. 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.
- O. 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.
- P. Perform system testing and commissioning of all security devices shown on the drawings.
- Q. 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.
- R. 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. Proximity/smart card readers.
 7. Magnetic door position contacts.
 8. Request to exit motion detectors.
 9. Access control system card stock.
 10. 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 two (2) years 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. Equipment Warranty: The Access Control System equipment shall carry a three (3) year manufacturer warranty. Damaged or defective 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.

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.
 - b. No Substitutions.
 - 4. 16-Output Card (Provide 1 output card per site).
 - a. Mercury Security Sy-MR16OUT.
 - 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. 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 PROXIMITY / CONTACTLESS SMART CARD READERS

- A. Provide proximity / 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. Connect card readers to the POE+ based door controller located above each card reader door.

- 1. Acceptable Products:

- a. Standard Size Readers:

- (1) HID Global Signo 40 (P/N 40TKS-T2-000000).
 - (2) No Substitutions.

- b. Narrow Mullion Mount Readers:

- (1) HID Global Signo 20 (P/N 20TKS-T2-000000).
 - (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 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 proximity/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.

2.12 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.

2.13 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.

2.14 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.
- ~~B. Furnish, install, mount, secure, aim, focus, adjust, connect power to, connect to the network, assign IP addresses, configure, test, commission and demonstrate all IP video surveillance cameras.~~
- ~~C. Furnish and install all necessary camera mounts and supports including ceiling mount kits, trim rings, gooseneck supports, corner mounts, pendant mounts, brackets, support arms, pole mounts, back boxes, etc. All screws and fasteners used for camera supports, raceway supports, junction boxes and pull boxes shall be vandal resistant (Torx Pin Head style).~~
- ~~D. Install CAT 6 cabling from each camera to CAT 6A patch panels as shown on the drawings. Furnish CAT 6 patch cords at the patch panel to connect the camera patch panel ports to owner furnished POE switches. NOTE—WCSD will cross connect cameras to the network switches at the Telecom Room. All CAT 6 cabling to be installed and tested in accordance with the Division 27 Specifications.~~
- ~~E. Furnish and install Milestone XProtect Corporate Version 10.x device “channel” software licenses for each new camera at each project location unless otherwise~~

~~noted. See camera schedule on the drawings for licensing requirements. Software licenses shall include a Milestone 1-year "Care Plus" Product Maintenance Agreement. Load license packs on WCSD's existing Milestone Management Server located at the East 9th Street Administration Offices and assign licenses to the camera at each project site.~~

- ~~F. Furnish, install, update and configure Milestone XProtect Corporate Version 10.x video "recording" software on the video recording server (video recording server hardware and server operating system provided and installed by WCSD).~~
- ~~G. Furnish, install, update and configure Milestone XProtect Smart Client video management software on a minimum of (3) client computers at each project location to enable users to view surveillance camera images and control cameras. Configure logical camera viewing groups and for each client computer as directed by WCSD.~~
- ~~H. Test, commission and demonstrate the entire IP video surveillance system in the presence of the Owner's Representative.~~
- ~~I. Provide a minimum of four (4) hours training to the Owner on the usage and operation of the IP video surveillance cameras, video recording server management software and client software. Training shall consist of two (2) 2-hour training sessions as scheduled by the Owner.~~

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 IP video surveillance system shall be a "Milestone Certified Partner" and shall have a Milestone Advanced Certification required to purchase and install the Milestone XProtect Corporate software.~~

~~D. The Contractor must be a Sony Security Preferred Reseller (SSPR).~~

~~E.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.

~~F.D.~~ The Contractor must be licensed by the Nevada State Contractors Board.

~~G.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 1080P dome cameras.
 - b. Outdoor fixed 4-sensor vandal resistant dome cameras.

- c. Camera supports including wall mount kits, corner mount kits, pole mount kits, gooseneck support arms, ceiling pendant kits, back boxes, etc.
- ~~d. Video Recording Software and Camera Licenses.~~
- ~~e-d.~~ CAT 6 Cabling – Indoor Plenum Rated.
- ~~f-e.~~ CAT 6A Field Mount Plugs.
- ~~g-f.~~ 48-Port CAT 6A Patch Panels.
- ~~h-g.~~ CAT 6 Patch Cords.
- ~~i-h.~~ Parking Lot Camera Powered POE Extenders.

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. _____
 - 4. All CAT 6 cables installed, terminated, labeled and tested. Certified test reports submitted to WCSD.
 - 5. All cameras properly aimed and focused as directed by WCSD IT.
 - 6. All Punchlist items completed.
 - 1. ~~All cameras mounted in accordance with the drawings.~~
 - 2. ~~All CAT 6 cables installed, terminated, labeled and tested. Certified test reports submitted to WCSD.~~
 - 3. ~~All cameras connected to the network and assigned IP addresses (WCSD to provide IP address scheme. WCSD to cross connect cameras to the network at the Telecom Room). Contractor to provide list of camera locations, hardware MAC addresses and IP addresses to WCSD.~~

4. ~~All cameras communicating and recording to the video "Recording" server.~~
5. ~~All cameras properly aimed and focused for both day and night operation.~~
6. ~~All cameras configured for proper aspect ratio, resolution, frame rate and video recording size.~~
7. ~~Video "Recording" software installed, updated and configured on the video recording server at each project location. Coordinate software installation with WCSD.~~
8. ~~The local video "Recording" server communicating with video "Management" server located at the East 9th Street Administration Offices over the wide area network.~~
9. ~~Device "channel" licenses for each camera installed on the video "Management" server.~~
10. ~~Client viewing and configuration software installed, updated and configured on a minimum of (3) client computers at each school location.~~
11. ~~Configure permissions on the recording servers to allow specific users to view live and recorded video.~~
12. ~~Entire video surveillance system tested and commissioned in the presence of the Owner's Representative.~~
13. ~~All Punchlist items identified during the testing and commissioning corrected to the satisfaction of the Owner's Representative.~~
14. ~~Operation and Maintenance manuals turned over to the Owner.~~
15. ~~Owner training 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 1080P 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).
 - 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 8-20 MEGA PIXEL 4-IMAGE SENSOR 4-CAMERA VANDAL RESISTANT DOME CAMERAS

A. Provide cameras meeting the following requirements:

1. Camera will consist of 4 individual ~~2MP~~ 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 ~~3MP~~ 5MP ~~1080P~~ 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 ~~P3727~~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.
- 2.3 HORIZONTAL PLENUM RATED CATEGORY 6 CABLE.
- A. See Section 271500 for requirements.
- 2.4 HORIZONTAL OSP RATED CATEGORY 6 CABLE.
- B. 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 ETHERNET / POE EXTENDERS FOR PARKING LOT LIGHT POLE MOUNTED CAMERAS

- A. Provide long range Ethernet Extender for light pole mounted cameras in the parking lot where shown on camera schedule.
- B. Extenders shall be wall mounted in the telecom room adjacent to wall mounted CAT 6 lightning protection entrance terminals. Input to the POE extenders shall be cross-connected to rack mounted 48-port CAT patch panels (see telecom drawings) via CAT 6 cable. Output of POE extenders shall be cross connected to wall mounted lightning protection entrance terminals via CAT 6 cable.
- C. Acceptable Products.
 - 1. Powered Ethernet Extenders:
 - a. Veracity Longspan VLS-1P-B transmitter, VLS-1P-C receiver and VPSU-57V-800 power supply.
 - b. Or Approved Equal.
 - 2. CAT 6 Entrance Protection Panels:
 - a. TII 606 Series Protection Panel with 65V Solid State Protector Modules P/N 606-65.
 - b. Or approved equal.

2.9 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.
- ~~A. Washoe County School District is currently standardized on the Milestone XProtect Corporate VMS software. The contractor shall integrate the cameras at each site with the existing software.~~
- ~~B. The contractor shall provide (1) Milestone XProtect Corporate "Device Channel License" for each camera as shown in the camera schedule. Each Device Channel License shall come with a Milestone 1 year "Care Plus" product maintenance agreement (PMA). During this 1-year period, Milestone will provide technical support and software upgrades at no cost to the School District.~~
- ~~C. See camera schedule for the required type and quantity of licenses.~~

- ~~D. Washoe County School District will provide and install a local "Recording Server" at each school. The contractor is responsible for providing, installing and configuring the Milestone XProtect Corporate "Recording Server" software on this server at each site.~~
- ~~E. Washoe County School District has an existing Milestone XProtect Corporate "Management Server" located at the East 9th Street Admin Office location. The contractor will be responsible for installing the "Device Channel Licenses" on this server and configuring the "Recording Server" at each site to communicate with this "Management Server".~~
- ~~F. At each project site (school) the contractor shall provide, install and configure "Client Viewing" software on (3) existing workstations as identified by WCSD. The contractor shall configure the client software to view cameras at the local school. Logical camera groups and screen layouts shall be configured on each computer.~~
- ~~A. Acceptable Products~~
 - ~~1. Milestone Systems XProtect Corporate Version 10.x Video Management System. Provide the following Software, Licenses and Product Maintenance Agreements (NOTE: Washoe County School Districts owns an XProtect Corporate "Base Server" license. The Contractor does not need to purchase an additional "Base Server" license for this project).~~
 - ~~a. Milestone Systems XProtect Corporate Version 10.x "Device Channel" License. Provide qty (1) license for cameras as shown in the Camera Schedule at each project site (Milestone P/N XPCODL).~~
 - ~~b. Milestone Systems XProtect Corporate Version 10.x "1 Year Care Plus" Produce Maintenance Agreement (PMA). Provide qty (1) 1-year PMA license for each camera shown in the Camera Schedule at each project site (Milestone P/N YXPCODL).~~
 - ~~c. No Substitutions accepted.~~

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.
 - a-d. Installation of Milestone Smart Client software on workstation computers at the project site.
-
- ~~2. Contractor shall procure cameras and provide a spreadsheet to WCSD 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.~~
 - ~~3. WCSD will procure the video recording server, install the server at the school and provide the contractor with logon credentials for the server.~~
 - ~~4. Contractor shall install, terminate and test cabling to the cameras. Contractor will provide certified cable test results to WCSD and provide patch cords for the cameras. WCSD will inspect the cabling installation and will issue a punchlist identifying any corrective action required. After the contractor has completed all punchlist items, WCSD IT will install the POE switches and patch cords to cross connect the cameras to the switches.~~
 - ~~5. Contractor shall connect, aim, focus and adjust the cameras. Each camera view must be reviewed and signed off by an Administrator or School Police Officer at the project site. WCSD's Project Manager will provide the contractor with the name of the person at each site responsible for signing off the camera views.~~
 - ~~6. Contractor shall install the Milestone Software on the recording server at the project site and shall configure communication between the recording server and the Milestone Management Server located at WCSD's East 9th Street administrative offices.~~
 - ~~7. Contractor shall assign new camera licenses to the Milestone Management Server as indicated in the camera schedule.~~
 - ~~8. Contractor shall configure all camera settings as required on the local site recording server including IP address, frame rate, compression, bit rate, motion detection, privacy masking, etc.~~
 - ~~9. Contractor shall configure storage locations for "live" recorded video and "archived" video on the server. Locate the recording server database on the local server hard drives (E: drive). Locate "archived" video on the~~

direct attached storage array (F: drive). Confirm storage locations with WCSD IT.

10. ~~Configure the recording server to overwrite "archived" video when the F: drive becomes greater than 80% full. Configure the software to overwrite the oldest video first.~~
11. ~~For each school site, the Contractor shall provide the names of the Principal, Vice Principal and Dean to the WCSD Project Manager. The Contractor shall assign view permissions to the cameras within the Milestone recording server software for the "STAFF" and "SCHOOL POLICE" groups. Only School Police, Principals, Vice Principals and Deans are allowed access via the Smart Client software. All other users must get permission from School Police.~~
12. ~~The Contractor shall configure logical site specific "camera viewing groups" within the Milestone Smart Client Software. The camera viewing groups shall be common to all users.~~
13. ~~WCSD IT will inspect the camera installation, software configuration and will issue a punchlist identifying any corrective action required. After the contractor has completed all punchlist items, the system will be re-inspected by WCSD IT.~~
14. ~~The Contractor shall install and configure the most current Milestone Smart Client software on three (3) computers at the project site as directed by the WCSD Project Manager.~~
15. ~~The Contractor shall provide 4 hours of training to the users at each project site. The training shall consist of (2) 2-hour training sessions as scheduled by WCSD.~~

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.
- I. ~~Logon to the camera and set the date and time. Set the time to Pacific Standard Time and configure the camera to automatically adjust to daylight savings time. Configure the camera to connect to a Network Time Protocol (NTP) server once every 24 hours and synchronize the time. Use WCSD's NTP server (IP Address 10.0.0.1 — verify with WCSD).~~
- J. ~~Add the camera to the database on the VMS "Recording Server" and load the appropriate drivers for the camera.~~
- K. ~~Configure camera ID, description and date/time stamping. The camera ID should follow the following naming convention: "School Name — Camera # — Area — Location". For example, Camera 3 at McQueen High would be named: "McQueen — 3 — 100 Wing — Main Entrance".~~
- L. ~~Change the default logon password on the IP camera web interface as directed by WCSD.~~

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.
- ~~P. Logon to the camera and set the date and time. Set the time to Pacific Standard Time and configure the camera to automatically adjust to daylight savings time. Configure the camera to connect to a Network Time Protocol (NTP) server once every 24 hours and synchronize the time. Use WCSD's NTP server (IP Address 10.0.0.1 – Verify with WCSD).~~
- ~~Q. Add the camera to the database on the VMS "Recording Server" and load the appropriate drivers for the camera.~~
- ~~R. Configure camera ID, description and date/time stamping. The camera ID should follow the following naming convention: "School Name – Camera # – Area – Location". For example, Camera 3 at McQueen High would be named: "McQueen – 3 – 100 Wing – Main Entrance".~~
- ~~S. Change the default logon password on the IP camera web interface as directed by WCSD.~~

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.
- ~~A. Configure the resolution on the cameras to the maximum setting 1920x1080 or 2048x1536 as applicable for each camera.~~
- ~~B. Aim the camera with the horizontal field of view shown on the drawings. Cameras set to a wider field of view than shown on the drawings or in a "fish-eye" configuration will be required to be re-adjusted by the contractor.~~

- C. ~~Adjust the vertical field of view so that the ceiling is not visible. For outdoor cameras, adjust the vertical field of view so that the sky is not visible. Secure the camera lens per the manufacturer's instructions.~~
- D. ~~Use the camera's web interface to focus the camera based on the field of view set above. Adjust the focus as necessary to provide a clear field of view.~~
- E. ~~Each school will have a dedicated onsite Representative responsible for reviewing and approving the aiming, field of view and focus of each camera. The contractor will be responsible for working with this dedicated representative and shall obtain the representative's sign-off for each camera. The contractor shall re-aim and/or re-focus the cameras as requested by Representative during testing/commissioning of the surveillance camera system.~~
- F. ~~After the aim and focus of each camera is approved by the onsite Representative, the contractor shall obtain a "screen shot" consisting of a full resolution JPG image of each camera view. The contractor shall submit color print outs on 8 1/2" x 11" of these images at the completion of the project.~~
- G. ~~Adjust the image quality settings on the camera to provide the clearest picture quality for all lighting conditions. The cameras have several settings that affect the image quality. The contractor shall consult with the camera manufacturer and shall adjust these settings to provide optimum image quality depending on the particular "scene" viewed by the camera.~~
- H. ~~Configure the cameras to automatically switch to daytime color and nighttime black & white mode as applicable for the lighting conditions.~~
- I. ~~For indoor cameras, configure the "motion" sensitivity settings within the video management software for each indoor camera so that images are only recorded when people or objects are moving within the field of view. Mask areas of the image that should not trigger motion based recording where applicable (i.e. ceilings, walls above 6' 0", trees, shrubs, etc). NOTE — THE PROPER CONFIGURATION OF THE MOTION SENSITIVITY SETTINGS IS CRITICAL TO THE PERFORMANCE OF THE SYSTEM. If the motion sensitivity is set too low, not all activity will be recorded by the system. If the motion sensitivity is set too high, images will be unnecessarily recorded resulting in server performance degradation and archiving issues.~~
- J. ~~Configure camera frame rate, compression and stream rate as follows:~~
 - 1. ~~Indoor Fixed Dome Cameras:~~
 - a. ~~Frame Rate — 15 fps.~~
 - b. ~~Compression — H.264.~~
 - c. ~~Bit Rate: 3mbps.~~
 - d. ~~Motion Detection: On — Record only when motion detected.~~
 - 2. ~~Outdoor Fixed Dome Cameras:~~

- a. ~~Frame Rate—15 fps.~~
- b. ~~Compression—H.264.~~
- c. ~~Bit Rate: 4mbps.~~
- d. ~~Motion Detection: Off—Record 24x7.~~

3. ~~Outdoor Fixed 4 Camera Sensor Cameras:~~

- a. ~~Frame Rate—10 fps.~~
- b. ~~Compression—H.264.~~
- c. ~~Bit Rate: 3-4mbps for each sensor (depending on size of view area).~~
- d. ~~Motion Detection: Off—Record 24x7.~~

3.8 ~~TESTING AND COMMISSIONING~~

A. ~~After completion of the project, the contractor shall test and commission the IP Video Surveillance System including all cameras and video management software in the presence of the Owner's Representative. The contractor shall notify the Owner's Representative a minimum of (1) week prior to testing.~~

B. ~~At a minimum, the following tests shall be performed.~~

- 1. ~~Verify physical mounting of all cameras.~~
- 2. ~~Verify network connectivity to all cameras.~~
- 3. ~~Verify aim and focus of all cameras.~~
- 4. ~~Verify that cameras have been properly focused for both daytime and nighttime use.~~
- 5. ~~Verify frame rate and image recording settings on all cameras.~~
- 6. ~~Verify privacy masking of camera views where applicable.~~
- 7. ~~Verify proper motion sensitivity adjustment of cameras.~~
- 8. ~~Verify archiving settings.~~
- 9. ~~Verify that device "channel" licenses have been installed on the "Management" server.~~
- 10. ~~Verify proper installation and configuration of the digital video recording software.~~
- 11. ~~Verify proper installation and configuration of the client software including permissions.~~

C. ~~After completion of the commissioning, the Owner's Representative shall prepare a Punchlist of all items to be corrected. After the contractor has completed the Punchlist items to the satisfaction of the Owner's Representative, the Project will be considered "substantially complete" at which time the warranty period will begin.~~

3.9 ~~TRAINING~~

A. ~~After completion of the camera installation, software installation, testing and commissioning, the contractor shall provide a minimum of 4 hours training to the Owner at each project location. Training shall cover usage and operation of the~~

~~cameras, video recording server software and client software. The training shall consist of two (2) 2-hour training sessions as scheduled by the Owner.~~

END OF SECTION

SECTION 283000 – 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.

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 or 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.

- I. 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 Modem4² 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.
 - 4. Where EMI may interfere with the proper operation of the IDS circuits, twisted/shielded cable shall be used.
- 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 shielded 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 shielded 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.
3. Install indoor/outdoor rated 62.5 micron multimode between main panel and remote panels as shown on the drawings.
 - a. Acceptable Products:
 - (1) Corning P/N 006K8F-31130-29.
 - (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 and conductor and cable shields 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 283100 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

1. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke, heat detectors and fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.
2. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
3. The contractor shall provide, from the acceptable manufacturer current product lines, equipment and components, which comply, with the requirements of these specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.
4. This section of the specification includes the furnishing, installation, and connection of an intelligent reporting, microprocessor controlled, addressable, fire detection system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.
5. The fire alarm system shall comply with requirements of NFPA standard 72 for protected premises signaling systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
6. The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.
7. The system and its components shall be underwriters laboratories, Inc. Listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
8. The installing company shall employ NICET (minimum level II fire alarm technology) technicians on site to guide the final check-out and to ensure the systems integrity.

9. Drawings and general provisions of the contract, including general and special conditions and the requirements of division 1 specifications, apply to this section.
10. 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.
11. 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.
12. 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.
13. The Contractor shall refer to Telecom drawings for information regarding additional specific monitoring requirements other equipment within the project.
14. The fire alarm system shall comply with the following codes:
 - a. 2018 IFC
 - b. 2018 IBC
 - c. 2021 NFPA 72
 - d. 2017 NFPA 70
 - e. Latest revisions of the Nevada Administrative Code section 477 by the Nevada State Fire Marshal
 - f. NNICC 2018 Amendments

1.2 RELATED SECTIONS

- A. Section 21 12 00 – Fire Suppression Standpipes: Flow detection and alarm devices.
- B. Section 21 13 13 – Wet-Pipe Sprinkler Systems: Flow detection and alarm devices.
- C. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.

- D. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
- E. Section 28 05 53 – Identification for Electronic Safety and Security.

1.3 REFERENCES

A. National Fire Protection Association (NFPA):

1. NFPA 13 – Installation of Sprinkler Systems.
2. NFPA 70 – National Electrical Code (NEC)
3. NFPA 72 – National Fire Alarm Code.
4. NFPA 90A – Standard for the Installation of Air Conditioning and Ventilating Systems.

B. Underwriters Laboratories (UL):

1. UL 268 – Standard for Smoke Detectors for Fire Alarm Signaling Systems.
2. UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems.
3. UL 268A – Standard for Smoke Detectors for Duct Applications.
4. UL 217 – Standard for Single and Multiple Station Smoke Alarms.
5. UL 521 – Standard for Heat Detectors for Fire Protective Signaling Systems.
6. UL 228 – Door Closers-Holders, With or Without Integral Smoke Detectors.
7. UL464 – Audible Signaling Appliances.
8. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
9. UL 1971 – Standard for Signaling Devices for the Hearing Impaired.
10. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
11. UL 1635 - Digital Alarm Communicator System Units

1.4 SYSTEM DESCRIPTION

- A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), power supplies, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.
 1. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
 2. The fire alarm system shall be manufactured by an ISO 9001 certified company.
 3. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).
 4. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

5. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.
6. A new intelligent reporting, microprocessor-controlled fire detection and notification system shall be installed in accordance with the specifications and as indicated on the Drawings.
7. Each Signaling Line Circuit (SLC) and Notification Appliance Circuit (NAC): Limited to only 80 percent of its total capacity during initial installation.
8. Control Panel shall be expandable, as necessary, to accommodate future expansion.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired as part of an addressable device connected by the SLC Circuit.
4. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
7. Notification Appliance Circuits (NAC) speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.

C. Basic System Functional Operation

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

1. The system alarm LED on the system display shall flash.
2. A local piezo electric signal in the control panel shall sound.
3. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

D. Sequence of Operations

1. Audible: Upon alarm activation of any area smoke detector, heat detector, manual pull station, and sprinkler waterflow, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel or command center.
 - b. The LCD Display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location and time/date.
 - c. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.

- d. The building notification system devices shall activate.
2. Visual: Activate visual strobes. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.
 - a. Activate visual strobes on the fire floors immediately. The visual strobe shall continue to flash until the system has been reset.
 - b. Transmit signal to the central station with point identification.
 - c. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
 - d. All self-closing fire/smoke doors held open shall be released.
3. Duct Smoke Activation – (Supervisory) The activation of any duct smoke detector, the following functions shall automatically occur:
 - a. The internal audible device shall sound at the control panel or command center.
 - b. Display the event on the graphical workstation and display a pictorial image.
 - c. The LCD display shall indicate all applicable information associated with the condition including; zone, device type, device location and time/date.
 - e. Transmit signals to remote or local annunciator LED's.
 - f. Transmit signal to the building automation system.
 - g. Transmit signal to the central station with point identification.
 - h. Shutdown the local air handling unit.
 - i. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
4. Supervisory Operation
 - a. Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, clean agent fire suppression system trouble, the following functions shall automatically occur:
 - b. The internal audible device shall sound at the control panel or command center.
 - c. Display the event on the graphical workstation and display a pictorial image.
 - d. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
 - f. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
 - g. Transmit signal to the central station with point identification.
5. Trouble Operation
 - a. Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
 - b. The internal audible device shall sound at the control panel or command center.
 - c. Display the event on the graphical workstation and display a pictorial image.
 - d. The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.
 - f. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.

- g. Transmit signal to the central station with point identification.

1.5 SUBMITTALS

- A. General Conditions: Submittal Procedures.
- B. Include sufficient information, clearly presented, to determine compliance with the specifications and the Drawings.
- C. Equipment Submittals:
 - 1. Cover Page: Indicate the following:
 - a. Project name and address.
 - b. Engineered systems distributor's name and other contact information.
 - c. Installing contractor's name and other contact information.
 - d. Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.
 - 2. Table of Contents: Lists each section of equipment submittal.
 - 3. Scope of Work Narrative: Detail indented scope of work.
 - 4. Bill of Material: Indicate for each component of system the following:
 - a. Quantity.
 - b. Model number.
 - c. Description.
 - 5. Highlight, underline, etc, equipment being specified.
 - 6. Battery Calculations: Show load of each of, and total of, components of system along with standby and alarm times that calculations are based on. Show calculated spare capacity and size of intended battery.
 - 7. Voltage Calculations: Supply Voltage drops for each notification appliance circuit, either in submittal or on drawings.
- D. Shop Drawings:
 - 1. Cover Page: Indicate the following:
 - a. Project name and address.
 - b. Engineered systems distributor's name and other contact information.
 - c. Installing contractor's name and other contact information.
 - d. Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.
 - 2. Floor Plans:
 - a. If a floor plan must be split using match lines to fit on the page, provide match lines and match line references that refer to sheet number that shows area on opposite side of match line.
 - b. Prepare using AutoCAD.
 - c. Show equipment and device locations.
 - d. Show wiring information in point-to-point format.
 - e. Include one line diagram showing all devices and circuiting as laid out on floor plan.
 - 3. Control Panel: Provide sheet that details exterior and interior views of control panel and clearly shows associated wiring information.
 - 4. Annunciator Panels: Provide sheet that details exterior and interior views of annunciator panels and clearly shows associated wiring information.

5. Sequence of Operations: Use matrix detailing activation of each type of device and associated resulting activation of the following:
 - a. Control panel.
 - b. Annunciator panels.
 - c. Smoke Detectors
 - d. Notification appliances.
 - e. Building fire safety functions, including elevator recall, elevator power shutdown, door lock release, door holder release, HVAC unit shutdown.
 - E. Certification: Submit with equipment submittals and shop drawings, letter of certification from major equipment manufacturer, indicating proposed engineered system distributor is an authorized representative of major equipment manufacturer. Include State of Nevada 'F' Card certifications and NICET II (Minimum) of employees in charge of project for the installing contractor.
 - F. Job Site Plans and Submittals: There shall be one set of original permitted drawings, submittals, and permit on the job site before any fire alarm installation can begin, this includes but is not limited to fire alarm back boxes. Coordinate with General Contractor. A copy of the permit shall be included with the operations and maintenance manuals once the job is completed.
 - G. Project Record Drawings:
 1. 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 contactors 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.
 2. Project record drawings shall be similar to shop drawings but revised to reflect changes made during construction.
 3. Provide and install document box adjacent to FACP with printed copy of record drawings, full size. Provide USB Flash Drive with latest system program in document box.
 - H. Operation and Maintenance Manuals:
 1. Submit complete operation and maintenance manuals within 14 calendar days after acceptance test.
 2. Operation and maintenance manuals shall be similar to equipment submittals, but revised to reflect changes made during construction.
 3. Operations and maintenance manuals shall include copies of inspection and field testing reports, preliminary and final testing reports, and Certificate of Occupancy.
- 1.6 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 shall be NICET Level II certified and registered with the State Fire Marshal.
- C. Submit a copy of the system supplier's training certification issued by the manufacturer of the integrated life safety system, and a copy of the installing technician's NICET certification.
- D. Designer shall be NICET Level II certified and a copy of the designer's NICET certification shall be submitted and their certification number shall be displayed on the drawings.

1.7 QUALITY ASSURANCE

- A. To ensure reliability and complete compatibility, all items of fire alarm system, including control panels, power supplies, initiating devices, and notification appliances, shall be listed by Underwriters Laboratories Inc. (UL) and shall bear "UL" label.
- B. Fire Alarm Control Panel Equipment: UL-listed under UL 864 Ninth Edition.
- C. The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment. Qualified and approved representatives of the system manufacturer shall produce all panel and equipment drawings and submittals, operating manuals. The contractor is responsible for retaining qualified and approved representative(s) of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: The owner will provide the Contractor with a lockable storage space for the Contractor's use during this project. Store materials in a clean dry indoor area and in accordance with manufacturer's instructions.
 - 1. In the event there is no overnight storage, materials brought to the job site shall be installed the same day. Contractor is responsible for the safe handling and storage of materials.
- C. Handling: Protect materials from damage during handling and installation.

1.9 COORDINATION

- A. Coordinate the Work of this section with the Work of other sections, including sprinkler systems as specified in Division 21, HVAC systems as specified in Division 23, and security/door locking systems as specified in Division 28.

1.10 WARRANTY

- A. Warranty Period for System Equipment: 1 year from date of final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. GE EST-4, no exceptions. (Per WCSD Standards)
- B. References to manufacturer's model numbers and other information is intended to establish minimum standards of performance, function, and quality.
- C. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.
- D. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.
- E. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- F. Substitute equipment proposed as equal to equipment specified shall meet or exceed requirements of this section.

2.2 CONDUIT AND WIRE

- A. Conduit:
 - 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
 - 2. All wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
 - 3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760.
 - 4. Wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
 - 5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.

6. Conduit shall be 3/4-inch (19.1 mm) minimum, factory painted red. Exposed conduit is not acceptable unless approved by the architect and WCSD Project Manager. Exposed conduit shall be painted at the direction of the architect.

B. Wire:

1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits, Signaling Line Circuits, and Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
5. All field wiring shall be electrically supervised for open circuit and ground fault.
6. T-Tapping of any fire alarm circuits is not acceptable unless approved by the manufacturers representative. T-Tapping of any notification circuits is strictly prohibited.

C. Terminal Boxes, Junction Boxes and Cabinets shall be UL listed for their use and purpose.

D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 SYSTEM COMPONENTS

A. Control Panel: Main FACP (or network node) shall be a modular type, analog/addressable, microprocessor based fire alarm panel designed specifically for fire alarm system. The control panel shall include all required hardware, software and site specific system programming to provide a complete and operational system.

1. The following shall apply:
 - a. Shall be capable of being front-panel programmed or by portable computer.
 - b. Individually supervised, panel mounted, power supply.
 - c. Backlit - LCD Display.
 - d. Support analog and addressable points plus 25% spare.

2.4 SYSTEM PERIPHERALS

A. Remote Annunciator:

1. Furnish and install as indicated on the Drawings a remote serial annunciator. Annunciator shall provide 80-character display, which shall duplicate all information on basic system display, including any network nodes its host panel is annunciating, with exception of menus. Contain the following function keys:
 - a. Alarm Acknowledge.
 - b. Trouble Acknowledge.
 - c. Signal Silence.
 - d. System Reset/Lamp Test.
 - e. System Drill Test.
2. Key Lock: Enable switches only when placed in "ON" position, with exception of Trouble Acknowledge, which is used to silence local trouble audible sounder. Annunciator shall contain the following LEDs:
 - a. Alarm.
 - b. Supervisory.
 - c. System Trouble.
 - d. Power Fault.
 - e. System Silenced.

B. Manual Fire Alarm Station:

1. Product Description: Manual Pull Stations shall be constructed of metal and double action. Provide with STI Stopper® II with Horn or equivalent (clear, tamperproof polycarbonate cover with sounder) where noted on plans.
2. Device shall be fully weatherproof rated and for wash down where shown on plans with 'WP' adjacent.
3. Mounting: Semi-Flush.

C. Spot Heat Detector

1. Product Description: Addressable combination rate-of-rise and fixed temperature, spot heat detector. Temperature Rating: 135 degrees F (57 degrees C). Rate-of-Rise: 15 degrees F (8.3 degrees C).
2. Devices in wash bay shall be conventional type with monitor module in backbox. Provide Thermotech 302-ET-135/194 or equivalent equal.

D. Ceiling Smoke Detector

1. Product Description: NFPA 72, addressable photoelectric type ceiling smoke detector with the following features:
 1. Adjustable sensitivity.
 2. Plug-in base.
 3. Integral thermal element rated 135 degrees F (57 degrees C).
 4. Visual indication of detector actuation.

E. Notification Devices

1. Devices shall be red with white lettering or white with red lettering, confirm with architect and owner prior to ordering material. All devices shall be LED type.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive fire alarm system.
 - 1. Notify Architect of conditions that would adversely affect installation or subsequent use.
 - 2. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install fire alarm system in accordance with NFPA 72, NFPA 70, state codes, manufacturer's instructions, and as indicated on the Drawings.
- B. Conceal conduit, junction boxes, and conduit supports and hangers in finished areas. Conceal or expose conduit, junction boxes, and conduit supports and hangers in unfinished areas.
- C. Do not install smoke detectors before system programming and test period. If construction is ongoing during this period, take measures to protect smoke detectors from contamination and physical damage.
- D. Flush-mount fire detection and alarm system devices, control panels, and remote annunciators in finished areas. Flush-mount or surface-mount fire detection and alarm system devices, control panels, and remote annunciators in unfinished areas.
- E. Ensure manual stations are suitable for surface mounting or semi-flush mounting as indicated on the Drawings. Install not less than 42 inches, nor more than 48 inches, above finished floor measured to operating handle.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide service of competent, factory-trained technician authorized by manufacturer to technically supervise and participate during pre-testing and acceptance testing of system.
- B. Testing:
 - 1. Conduct complete visual inspection of control panel connections and test wiring for short circuits, ground faults, continuity, and insulation before energizing cables and wires.
 - 2. Close each sprinkler system control valve and verify proper supervisory alarm at Control Panel.
 - 3. Verify activation of flow switches.
 - 4. Open initiating device circuits and verify that trouble signal actuates.
 - 5. Open signaling line circuits and verify that trouble signal actuates.
 - 6. Open and short notification appliance circuits and verify that trouble signal actuates.
 - 7. Ground initiating device circuits and verify response of trouble signals.
 - 8. Ground signaling line circuits and verify response of trouble signals.
 - 9. Ground notification appliance circuits and verify response of trouble signals.
 - 10. Check installation, supervision, and operation of intelligent smoke detectors.
 - 11. Introduce on system each of the alarm conditions that system is required to detect. Verify proper receipt and proper processing of signal at Control Panel and correct activation of control points.

12. Consult manufacturer's manual to determine proper testing procedures when system is equipped with optional features. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality, and similar.

C. Acceptance Testing:

1. Before installation shall be considered completed and acceptable by AHJ, a complete test using as a minimum, the following scenarios shall be performed and witnessed by representative approved by Engineer. Monitoring company and/or Nevada State Fire Marshal Division shall be notified before final test in accordance with local requirements.
2. Contractor's job foreman, in presence of representative of manufacturer, representative of Owner, and Nevada State Fire Marshal Division shall operate every installed device to verify proper operation and correct annunciation at control panel.
3. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify presence of supervision.
4. When testing has been completed to satisfaction of both Contractor's job foreman and representatives of manufacturer and Owner, a notarized letter co-signed by each attesting to satisfactory completion of said testing shall be forwarded to Owner and Nevada State Fire Marshal Division.
5. Leave fire alarm system in proper working order and, without additional expense to Owner, replace defective materials and equipment provided within 1 year (365 days) from date of final acceptance by the owner.

3.4 DEMONSTRATION

- A. Provide instruction as required for operating fire alarm system.
- B. Provide hands-on demonstrations of operation of fire alarm system components and functions.
- C. Provide minimum 4-hour training session for owner upon completion of project.

3.5 SPARE PARTS

- A. Provide 2 spare of all intelligent devices on project.
- B. Provide 2 extra devices of each type of notification device.
- C. Provide 4 extra keys of each type.

END OF SECTION 283100

SECTION 328000 - IRRIGATION

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. Plant irrigation system
 - 2. Automatic controller
 - 3. Remote control valves
 - 4. Trenching
 - 5. Sleeves
 - 6. Backfilling

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Before any irrigation system materials are delivered to the job site, submit to the Owner a complete list of all irrigation system materials proposed to be furnished and installed. Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to method of installation.
- B. Provide at least one person who shall be present at all times during execution of this portion of the work, and who shall be thoroughly familiar with the type of materials being installed, and material manufacturer's recommended methods of installation, and who shall direct all work performed under this section. The Contractor shall have a minimum of 5 years experience in commercial or residential irrigation installation

1.6 CLOSEOUT SUBMITTALS

A. Record Drawings

1. Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Locations shown on as-built drawings shall be kept day to day as the project is being installed. All dimensions noted on drawings shall be neat and legible. Show locations and depths of the following items: Point of connection, Routing of sprinkler lines, Ball valves, Sprinkler control valves, Quick coupling valves, Routing of control and power wires, Sprinkler heads, Other related equipment.
2. Record drawings must be delivered to the Owner upon completion.

B. Operations and Maintenance Manual

1. Prepare and deliver to the Owner within ten calendar days prior to completion of construction, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in four individually bound copies of the operations and maintenance manual. The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Spare parts lists and related manufacturer information shall be included for each equipment item installed. Each complete, bound manual shall include the following information:
 - a. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment with names and addresses of local manufacturer representatives.
 - b. Complete operating and maintenance instructions on all major equipment.
2. In addition to the above maintenance manuals, provide the maintenance personnel with instructions for system operation and show written evidence to the Owner at the conclusion of the project that this service has been rendered.
3. Final payment will not be made until record drawings and operation and maintenance manuals have been submitted and approved.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.
4. Store materials per manufacturer's specifications.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

1.10 WARRANTY

- A. Warranty requirements will be submitted to Owner upon substantial completion of work.
- B. The Contractor shall winterize the system and perform spring start-up of the system during the guarantee period. These functions shall be coordinated in advance with the Owner, and the Owner's personnel shall be encouraged to participate.
 1. Upon re-energizing the system, the Contractor shall repair any leaks or breaks and shall check each head and valve, making any adjustment necessary.
 2. Warranty Period: 12 months from date of irrigation completion.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE

- A. All mainlines and transmission lines shall be Schedule 40 PVC; laterals shall be schedule 40 PVC. Pipe shall be rigid unplasticized conforming to ASTM D-1784 and D-2241 standard specifications for PVC pipe. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles, and dents.
- B. All pipe shall be continuously and permanently marked with the following information: Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73F (23C), color pantone #512, and National Sanitation Foundation (N.S.F.) approval.
- C. All above ground piping shall be epoxy painted purple (pantone color #512) and have a purple tag attached with the wording "warning recycled/reclaimed water do not drink" and "aviso agua impura no tomar" (t. christy enterprises, maxi valve identification tag, id-max-p2-rc006 or city of sparks approved equal).

2.2 MANUAL VALVES

- A. All manual ball valves, sizes three-inch (3") (75mm) and smaller, shall be full ported ball valves with maximum working pressure of 175 psi (1200kPa) and 350 psi (2400kPa) hydrostatic test pressure.
- B. All manual gate valves of four-inch (4") (100mm) size or larger shall be iron body, brass trimmed, double disc wedge type with integral taper seats and with non-rising stems, and shall be Mueller A-2360 resilient wedge gate valves with mechanical joints or equal accepted in advance by the owner. All manual gate valves shall be 200 psi (1380kPa) rated.

2.3 VALVE BOXES

- A. All remote control valves, manual control valves, zone shut-off valves, ball valves, or globe valves unless otherwise indicated, shall be installed in valve access box of proper size as required for easy access to the valve.
- B. Valve boxes shall not be located within a planting area. Valve boxes shall be placed with a minimum of five feet (5') (1.5m) separation between each valve box.
- C. All covers for meter boxes, valve boxes, flush valves, pressure reducing vaults, air/vac release assemblies, and all other appurtenances requiring vaults or boxes shall be purple in color (pantone color #512), labeled "reclaimed water" or "effluent", and have secured or locking lids. purple coloration shall be obtained from the manufacturer or be applied by powder coating or epoxy paint. all appurtenances shall have a purple tag attached with the wording "warning recycled/reclaimed water do not drink" and "aviso agua impura no tomar" (t. christy enterprises, maxi valve identification tag, id-max-p2-rc006 or city of sparks approved equal). a debris cap with purple coloration shall be installed inside of all round boxes.

2.4 EMITTERS

- A. All emitters of a particular type and for a particular function in the system shall be of the same manufacture and shall be marked with the manufacturer's name and identification, in such a position that they can be identified without being removed from the system.

2.5 IRRIGATION CONTROLLERS

- A. Field controllers shall be model numbers and manufacturers as shown on the plans or an acceptable equal.
- B. Field controllers shall be installed on approved concrete bases in accordance with the manufacturer's recommendations as shown on the drawings.
- C. Field controllers shall be installed with manufacturer's lightning and surge protection.
- D. Central controller shall be model number and manufacturers as shown on the plans, or acceptable equal. Central controller shall be located as shown on the drawings.

- E. On site lockable disconnects or lockable fuse block and a 110 volt outlet shall be installed at each controller in a separate lockable water-tight enclosure.
- F. All irrigation controller enclosures shall be labeled inside and outside warning that the system uses reclaimed water (t. christy enterprises, controller marking decal, part number #id-4100, or city of sparks approved equal).

2.6 REMOTE CONTROL VALVES

- A. All remote control valves shall be model numbers and manufacturers as shown on the plans or an acceptable equal. All splices shall be installed with 3M DBY and DBR types and all splices shall be made inside the valve box.

2.7 CONTROL WIRE

- A. All electric control and ground wire shall be irrigation control cable or approved equal, 14-gauge unless otherwise indicated on the drawings. All wiring to be used for connecting the automatic remote control valve to the automatic controllers shall be Type "UF", 600 volt, solid copper, single conductor wire with PVC insulation and bear UL approval for direct underground burial feeder cable.
- B. Insulation shall be 4/64-inch (1.6mm) thick minimum covering of ICC-100 compound for positive waterproofing protection. When more than one valve is operated by a single controller station, provide separate control wire from the controller to each valve, and one valve per box. Each valve should have no less than twenty-four inches (24") (600mm) of control cable inside valve box. Each wire shall be labeled at the valve box and at the controller to what zone each wire controls.
- C. Verification of wire types and installation procedures shall be checked to conform to local codes.

2.8 FITTINGS

- A. All plastic pipe fittings shall be permanently marked with the following information: Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73F (23C), and National Sanitation Foundation (N.S.F.) approval.
- B. All plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld or screwed connections.
- C. Slip fitting socket taper shall be so sized that a dry unsoftened pipe end, conforming to these special provisions, can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be permitted. Only schedule 80 fittings may be threaded.

- D. When connection is plastic to metal, plastic male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon Tape and Teflon paste. No oil-based products permitted.
- E. Solvent weld fittings shall be manufactured by Lasco, Spears, or acceptable equal. All lateral line fittings and mainline fittings two inches (2") (50mm) and smaller shall be schedule 40 solvent weld fittings.

2.9 SLEEVES

- A. Pipe sleeves shall be Schedule 40 PVC pipe, or equal.

2.10 CONCRETE

- A. All concrete shall be 3,000 psi (20,700kPa) at 28 days, transit mixed. Provide certifications with each delivery.

2.11 OTHER MATERIALS

- A. All other materials, not specifically described, but required for a complete and proper irrigation system installation, shall be new, first quality of their respective kinds, and included within the submittal to the Owner for approval.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installed work and materials of all other trades.
- B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the owner and at no additional cost to the owner.

3.2 SURFACE CONDITIONS

- A. Inspection
 - 1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 - 2. Verify that trenching may be completed in accordance with the original design and the referenced standards.
 - 3. In the event of discrepancy, immediately notify the owner. Do not proceed with installation in areas of discrepancy until all discrepancies have been fully resolved.

3.3 TRENCHING

- A. Perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these Specifications.
- B. Make all trenches in accordance with OSHA Requirements with sufficient width to provide free working space at both sides of the trench and around the installed item as required for gluing, joining, backfilling, and compacting while minimizing width of trenches.
- C. All mainline shall have a minimum cover of thirty six inches (36") and a maximum cover of forty eight (48") above the pipe. All laterals shall be the same depth as the mainline. All lateral and main lines shall be installed in a straight line with no arching or bending of pipe. Change in direction of pipe shall occur only with the use of proper fittings only.
- D. Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the owner and then compact to provide a firm and unyielding subgrade to the approval of the owner and at no additional cost to the owner.
- E. Trench Bracing
 - 1. Properly support all trenches in strict accordance with all pertinent rules and regulations.
 - 2. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind will be fully protected from damage.
 - 3. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the owner and at no additional cost to the owner.
 - 4. Arrange all bracing, sheeting and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to provide sufficient strength.
 - 5. Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported.
- F. Grading and Stockpiling Trenched Material
 - 1. Control the stockpiling of trenched material in a manner to prevent water running into the excavations.
 - 2. Do not obstruct surface drainage but provide means whereby storm and waste waters are diverted into existing gutters, other surface drains, or temporary drains.
- G. All trench excavation shall be made by open cut. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading, and to prevent slides or cave-ins. The Contractor shall

remove all material not required for backfill or not suitable for backfill, from the site. Banks of trenches shall be kept as nearly vertical as possible, and shall be properly sheeted and braced as may be necessary to prevent caving.

- H. Trench widths in paved streets or in areas where proximity to other structures require vertical cuts, shall not be wider than is required for proper handling, jointing and bedding of the pipe.
- I. The bottom of the trenches shall be accurately graded to line and grade, and provide uniform bearing and support for each section of the pipe on undisturbed soil, at every point along its entire length. Depressions for joints shall be dug after the trench bottom has been graded, and shall be only of such length, depth and width as required for properly making the particular type joint. Care shall be taken not to excavate below the depths indicated.
- J. Where rock occurs in trench excavation, the rock shall be removed to a depth of six inches (6") (150mm) below the established grade line, and to a width of twelve inches (12") (300mm) greater than the outside diameter of the pipe to be installed in the trench.
- K. Where excavation of trenches requires the removal of asphalt pavement, the pavement shall be cut in a straight line along the edge of the excavation by use of a spade-bitted air hammer, concrete saw, or similar approved equipment to obtain straight, square and clean break; and, after backfilling and subgrade preparations are completed, hot plant mix asphalt concrete shall be replaced and compacted in accordance with the appropriate standard specification. Replaced base course and asphalt shall match removed sections.
- L. Excess material, including rock, broken concrete, bituminous materials, debris, or other materials not suitable for backfill, shall be removed from the site and disposed of by the Contractor.

3.4 SLEEVES

- A. Sleeves shall be installed wherever routing of a pipe, wiring, or both crosses a paved area or passes through a bored hole.
- B. Sleeves laid in open trenches shall be uniformly and evenly supported by undisturbed soil on the trench bottom. Backfill shall conform to standards hereinafter specified.

3.5 BACKFILL

- A. The trenching shall not be backfilled until inspection by the City has been completed and the pipe installation, including the grade, alignment, and jointing has been found to be in compliance with the requirements of the plans and specifications.

- B. Select backfill material consisting of sand, fine gravel or select earth, free of large lumps or rocks larger than one inch (1") (25mm) shall be used in backfilling around and over the installed pipe.
- C. The select material shall be obtained from the excavation material removed from the trench and shall be processed by screening, sifting, or selective sorting, so as to produce the type of backfill herein specified. The Contractor may at his option and own expense provide an acceptable imported material.
- D. This backfill material shall be carefully deposited around and over the pipe in layers not more than six inches (6") (150mm) thick, loose measurement, unless otherwise permitted by the City, wetted to optimum moisture content and uniformly compacted to at least 95 percent of the maximum density obtainable at optimum moisture content as determined by AASHTO T99 Method A or D (latest revision), until the pipe has a cover depth of at least twenty four inches (24").
- E. The remaining depth of the trench shall be backfilled with excavation material removed from the trench, which shall be wetted or dried to near optimum moisture content.

3.6 INSTALLATION OF PIPING

- A. Perform all trenching and backfilling as specified by the specifications in this Section.
- B. Lay out the piping system in strict accordance with the plans. Where piping is shown on the plans to be under paved areas, but running parallel and adjacent to planted areas, the intention is to install the piping in the planted areas.
- C. All mainlines and laterals shall be installed with thirty six inches (36") minimum cover, and a maximum of forty eight inches (48") cover, over the pipe.
- D. All lines shall have a minimum clearance (horizontal and vertical) of four inches (4") (100mm) of adjacent pipe from each other, and six inches (6") (150mm) from lines of other trades, except through pipe sleeves. Parallel lines shall not be installed directly over one another.
- E. Carefully inspect all pipe and fittings before installation, removing all dirt, scale, and burrs and reaming as required; install all pipe with all markings up for visual inspection and verification.
- F. PVC Pipe
 - 1. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
 - 2. All plastic joints shall be solvent-weld joints. Only the solvent cement recommended by the pipe manufacturer shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall

be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

3. All plastic to metal joints shall be made with plastic adapters.
4. The solvent-weld joints shall be made dry.
5. The solvent-weld joints shall be allowed to set at least 24 hours before pressure is applied to the system on PVC pipe.
6. Swing joints shall be installed on the same side of the pipe as the head. Swing joints may not cross pipe laterally.

3.7 INSTALLATION OF EQUIPMENT

- A. All fittings, valves, etc. shall be carefully placed in the trenches as shown on the plans.
- B. All control wires shall be clearly labeled, by station, using weatherproof material, both at the controller and at the valve. The outside cover of all automatic valve boxes shall also have the station number clearly stamped on the cover.

3.8 TESTING AND INSPECTION

- A. Closing-in Work
 1. Do not allow or cause any of the work in this section to be covered up or enclosed until it has been inspected, tested, and approved by the owner.
 2. Where trenches are not closed at the end of the day Contractor shall accept all liability for any damage or injury that may result from open trenches. Provide barricades and warning tape as necessary around all open trenches.
- B. Before backfilling the mainline, and with all control valves in place, completely flush and test the mainline and repair all leaks; flush out each section of lateral pipe before sprinkler heads are attached.
- C. Testing
 1. Make all necessary provisions for thoroughly bleeding the line of air and debris.
 2. Before testing, fill the line with water for a period of at least 24 hours.
 3. After valves have been installed, test all installed irrigation lines for leaks at a pressure of 150 psi (1035 kPa) for a period of two hours, with all couplings exposed and with all pipe sections center loaded.
 4. Furnish all necessary testing equipment and personnel.
 5. Correct all leaks and retest until acceptance by the Engineer.
- D. Final Inspection
 1. Thoroughly clean, adjust, and balance all systems.

- E. Demonstrate the entire system to the Engineer, proving that all remote control valves are properly balanced, that all heads are properly adjusted for radius and arc of coverage, and that the installed system is workable, clean, and efficient.

END OF SECTION 328000

SECTION 329113 - SOIL PREPARATION

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 planting soils.

1.3 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- K. Planting Soil: Imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. 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.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.7 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 - 1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

- a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
 2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
 2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
 3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
 4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.
- D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT WERA-103, including the following:
1. Percentage of organic matter.
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).
 4. Buffered acidity or alkalinity.
 5. Nitrogen ppm.
 6. Phosphorous ppm.
 7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.
 12. Copper ppm.
 13. Sodium ppm[and sodium absorption ratio].
 14. Soluble-salts ppm.
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.

- E. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
 - 1. Fertilizers and Soil Amendment Rates: State recommendations in weight per cu yd of soil.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Do not move or handle materials when they are wet or frozen.
 - 4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
- B. Planting-Soil: Manufactured soil consisting of manufacturer's basic topsoil, blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials to produce viable planting soil.
 - 1. Additional Properties of Manufacturer's Basic Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 5 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
 - 2. Unacceptable Properties: Manufactured soil shall not contain the following:
 - a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
 - b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil.
 - c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches (50 mm) in any dimension.

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 a No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through a No. 60 (0.25-mm) sieve.
 - 2. Class: O, with a minimum of 95 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through a No. 60 (0.25-mm) sieve.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through a No. 40 (0.425-mm) sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 (0.30-mm) sieve.
- F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance".
- B. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
- C. 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. 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: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329113

SECTION 329300 - PLANTS

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. Plants.
 - 2. Tree stabilization.
 - 3. Landscape edgings.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- G. Finish Grade: Elevation of finished surface of planting soil.

- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. 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.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
- B. Samples for Verification: For each of the following:
 - 1. Mineral Mulch: 2 lb (1.0 kg) of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
 - 2. Weed Control Barrier: 12 by 12 inches (300 by 300 mm).
 - 3. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
 - 1. Experience: Three > years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
 - 1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
 - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
- D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. 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.
- D. Handle planting stock by root ball.
- E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- F. 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. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 2. Do not remove container-grown stock from containers before time of planting.
 3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.10 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Planting Restrictions: Plant during one of the following periods..
 1. Spring Planting: April 1 – June 15.
 2. Fall Planting: September 1 – November 15.

- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.11 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.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods: From date of planting completion.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: Three months.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated 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.
 - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots are unacceptable.
 - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 FERTILIZERS

- A. 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.

2.3 MULCHES

- A. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:
 - 1. Type: [Rounded riverbed gravel or smooth-faced stone] [Crushed stone or gravel] [Marble chips] [Granite chips] <Insert stone type>.
 - 2. Size Range: As indicated on plans.
 - 3. Color: Readily available natural gravel color range acceptable to Architect.

2.4 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.

2.5 PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.6 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
2. Guy Cables: Five-strand, 3/16-inch- (4.8-mm-) diameter, galvanized-steel cable, with zinc-coated turnbuckles a minimum of 3 inches (75 mm) long, with two 3/8-inch (10-mm) galvanized eyebolts.
3. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

2.7 LANDSCAPE EDGINGS

a.

B. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221 (ASTM B 221M), Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.

1. Edging Size: [3/16 inch (4.8 mm) thick by 5-1/2 inches (140 mm) deep.
2. Stakes: Aluminum, ASTM B 221 (ASTM B 221M), Alloy 6061-T6, approximately 1-1/2 inches (38 mm) wide by 12 inches (300 mm) long.
3. Finish: Manufacturer's standard finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."
- B. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. 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.
 - 2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - 5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 6. Maintain supervision of excavations during working hours.
 - 7. Keep excavations covered or otherwise protected [overnight] [after working hours] [when unattended by Installer's personnel].
- B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.
- C. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- D. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
 - 1. Backfill: Planting soil.
 - 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - 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 equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Two per plant.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
 - 1. Backfill: Planting soil.
 - 2. 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 equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Two per plant.
 - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Slopes: 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.

3.6 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 as directed by Architect.
- C. 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.
- D. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
 - 1. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1830 mm) above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 - 2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
 - 3. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough 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.

3.9 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches (150 mm) and secure seams with galvanized pins.

- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Mineral Mulch in Planting Areas: Apply 3-inch (75-mm) average thickness of mineral mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area], and finish level with adjacent finish grades. Do not place mulch within 3 inches (75 mm).

3.10 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- 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 integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.11 REPAIR AND REPLACEMENT

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Species of Replacement Trees: Species selected by Architect.

3.12 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. 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.

- D. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

END OF SECTION 329300

SECTION 335210 – FUEL SYSTEMS SERVICE STATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Delegated Design-Build requirements for fueling system service station
- B. Related Requirements:
 - 1. Section 011000 "Summary" for use of the premises and phasing requirements.

1.2 REFERENCES

- A. ASME B31.3: Process Piping
- B. NFPA 30: Flammable and Combustible Liquids Code
- C. NFPA 30A: Code for Motor Fuel Dispensing Facilities and Repair Garages
- D. NFPA 70: National Electrical Code

1.3 PREINSTALLATION MEETINGS

- A. Preconstruction Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Shop Drawings: Provide drawings and specifications as required by the Nevada LP-Gas Board for permit application.
- B. Product Data: For all components
- C. Certificates:
 - 1. Contractor Qualifications
 - 2. Licensed Personnel
- D. Operation and Maintenance Data

1.5 QUALITY ASSURANCE

- A. Each installation Contractor must have successfully completed at least 3 projects of the same scope and the same size, or larger, within the last 6-years; demonstrate specific installation experience in regard to the specific system installation to be performed; have taken, if applicable, manufacturer's training courses on the installation of piping; and meet the licensing requirements in the state. Experience must include the erection of piping systems in compliance with the requirements of ASME B31.3, NFPA 30, and NFPA 30A. Submit a letter listing prior projects, the date of construction, a point of contact for each prior project, the scope of work of each prior project, and a detailed list

of work performed providing in the letter evidence of prior manufacturer's training and state licensing.

1.6 REGULATORY REQUIREMENTS

- A. Licensed Personnel: Pipe installers must be licensed/certified when the state, city or locality requires licensed installers.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle, store, and protect system components and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations. Replace damaged or defective items.

1.8 FIELD CONDITIONS

- A. Fuel required for the testing, flushing and cleaning efforts will be provided and delivered by the Contractor. Fuel used in the system will remain the property of Washoe County School District.

1.9 COORDINATION

- A. Arrange construction so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with all applicable laws and regulations.
- B. Delegated Design Build Criteria: Fueling area to be design-build. Refer to Sheet A1.21. Not all elements (piping, hanging hardware, turbines, valves, etc.) are shown on the plans or listed in the schedule provided on sheet A1.21. Contractor is to provide all elements required for a functional and code compliant fueling system. Fueling contractor is to provide required drawings and specifications for required permit applications and make any revisions as required by the permitting agencies. Contractor is responsible for obtaining the permits, including any permit fees.
- C. Permits:
 - 1. Nevada LP-Gas Board: Class 5 License
 - 2. Washoe County Health District: Gasoline Dispensing Facility Air Quality Stationary Source Permit to Operate
 - 3. City of Sparks: Construction Permit
 - 4. Any other required permits
- D. Related Drawings:
 - 1. A1.21 – Fueling Area
 - 2. All Civil drawings
 - 3. Structural Detail 4/S4.2
 - 4. Electrical **sheets E6.04 and WB-E3.05** (Volume 2)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing must be in accordance with ASME B31.3 and NFPA 30. Safety rules as specified in NFPA 30 must be strictly observed. Never direct bury threaded connections, socket welded connections, unions, flanges, valves, air vents, or drains. Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible.

3.2 FIELD QUALITY CONTROLS

- A. Testing:
 - 1. Furnish labor, materials, equipment, electricity, repairs, and retesting necessary to ensure a functional system.

3.3 DEMONSTRATIONS

- A. Conduct a training session for designated Washoe County School District personnel in the operation and maintenance procedures related to the system components and specified herein. Include pertinent safety operational procedures in the session as well as physical demonstrations of the routine maintenance operations. Furnish instructors who are familiar with the installation/system components/systems, both operational and practical theories, and associated routine maintenance procedures. The training session must start after the system is functionally completed, but prior to final system acceptance. Submit a letter, at least 14 working days prior to the proposed training date, scheduling a proposed date for conducting the onsite training.

END OF SECTION 335210

SECTION 41 22 46 – CEILING MOUNTED WORK STATION BRIDGE CRANE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Ceiling mounted, work station, steel bridge crane including hanger assemblies, runways, movable bridge, hoist trolley, tractor drive, hoist, festooning system, and other accessories.
- B. Related sections:
 - 1. Section 133419 “Metal Building Systems” for engineered metal building system designed to support crane and live loads.
 - 2. Division 26 - Electrical: Electrical supply, conduit, wiring, and other electrical components for powering lifting device hoist trolley tractor drive.
 - 3. **Section 416720 “Fall Arrest Anchor System” for overhead mounted fall arrest system that may be combined with bridge crane.**

1.2 REFERENCES

- A. American Institute of Steel Construction (AISC): Manual of Steel Construction, Part 5, Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.
- B. American National Standards Institute (ANSI):
 - 1. ANSI B30.11 - Monorails and Underhung Cranes.
- C. American Society for Testing and Materials (ASTM) Publications:
 - 1. ASTM A36 - Carbon Structural Steel.
 - 2. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength.
 - 3. ASTM A490 - Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
- D. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code.
- E. Occupational Safety and Health Administration (OSHA): OSHA Specification 1910.179 - Overhead and Gantry Cranes.

1.3 PERFORMANCE REQUIREMENTS

- A. Crane shall provide coverage of rectangular area of size indicated on Drawings and consist of:
 - 1. Overhead hanger assemblies leaving crane operating area free of support structures.
 - 2. Two rigid, parallel runways. Cranes with more than two runways or with articulating runways are not acceptable.
 - 3. Rigid, single girder bridge moving perpendicular to runways. Double girder bridges and ones with articulating or threaded connections are not acceptable.
- B. Modular, pre-engineered design: Crane system shall be capable of expansion, disassembly and relocation, and accepting additional or multiple mixed capacity bridges.
- C. Productivity ratio: Crane shall be designed to manually move load with maximum force of 1/100 load weight.
- D. Runway and bridge track: Enclosed type limiting dust and dirt collection on rolling surfaces with maximum deflection of 1/450 span based on capacity plus 15 percent for lifting device weight.
- E. Crane operating temperature: 5 to 200 degrees F.
- F. Crane shall be designed to withstand:
 - 1. Crane and hoist dead load.
 - 2. Live load capacity equal to net rated hook load: 3,000 lbs .
 - 3. Inertia forces from crane and load movement.

1.4 SUBMITTALS

- A. Provide in accordance with Section 01 33 00 - Submittal Procedures:
 - 1. Product data for crane and accessories. Describe capacities, performance, operation, and applied forces to foundation.
 - 2. Shop drawings showing crane configuration, dimensions, wiring diagrams, and construction and installation details.
 - 3. Copy of warranty required by Paragraph 1.6 for review by Architect.
 - 4. Manufacturer's installation instructions.
 - 5. Manufacturer's operation and maintenance manual.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in designing and manufacturing cranes with 25 years successful experience.
- B. Installer: Company experienced in assembly and installation of cranes with 5 years successful experience and acceptable to crane manufacturer.
- C. Crane shall be designed, fabricated, and installed in accordance with ANSI B30.11, and OSHA 1910.179.
- D. Base crane structural design includes full rated load capacity plus 15 percent for hoist and trolley weight and 25 percent impact factor for speed of lifting device and weight of tooling.
- E. Perform welding by certified operators in accordance with AWS D14.1.
- F. Bolted connections shall be in accordance with torque tightening procedures specified in AISC Manual, Part 5.
- G. Clearly label crane with rated load capacity. Place label at height and location easily read from floor level and loading position.

1.6 WARRANTY

- A. Provide under provisions of Section 01 78 00 - Closeout Submittals:
 - 1. 10 year warranty for crane to cover defects in materials and workmanship.
 - 2. 2 years warranty for motorized tractor drive.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Gorbel, Inc., P.O. Box 593, Fishers, New York 14453-0593; 800-828-0086; www.gorbel.com.
- B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01 25 13 - Product Substitution Procedures.

2.2 CEILING MOUNTED WORK STATION STEEL BRIDGE CRANE

GLCS: Cranes with trussed steel runways supported at 20 feet ~~(6.1 meters)~~ maximum **17 feet 9 inches**.

- A. Type: Ceiling mounted, work station, all-steel construction, bridge crane with overhead hanger assemblies, two runways, bridge moving perpendicular to runways, and equipped with enclosed track, end trucks, hoist trolley, tractor drive, festooning system, bumpers, and other accessories; Model No. GLCS-4000-16S-110 as manufactured by Gorbel, Inc.
- B. Runway length: 110 feet.
- C. Bridge length: ~~46~~ **15** feet
- D. Construction: Fabricate from ASTM A36 steel sections with finished ends and surfaces.
 - 1. Hanger assemblies: Provide number and type of hanger assemblies required for suspending runways from overhead steel beam support structure.
 - a. Equip assemblies with upper hanger bracket adjustable for mounting to 1 to 10 inch [25 to 254mm] wide flanges.
 - b. Two-piece hangers suspending runways below support beams shall consist of upper hanger bracket with beam clips and lower runway bracket connected with B7 alloy threaded steel rod. Provide rods in 20 and 72 inch lengths for field cutting. Assemblies shall be designed for supporting either plain enclosed steel track runways or trussed steel runways.
 - c. Hangers for flush mounting plain or trussed enclosed steel track shall be one-piece assembly designed for runways either parallel or perpendicular to support beams.
 - 2. Sway bracing: ~~Brace runways as detailed on Drawings and specified in Section 05 12 00 – Structural Steel. Provide runways with sway brace fittings for attachment of 1 inch diameter diagonal pipe bracing to top chord of trussed runway.~~ **Brace runways as required for seismic classification designated on drawings and for other design loads. Design of bracing part of metal building system delegated design.**
 - 3. Runways: Vierendeel truss fabricated from square steel tubes and enclosed steel track.
 - a. Track: Enclosed, cold formed, steel box track which serves as bottom cord of runway and permits end trucks and festoon carriers to ride on lower inside flanges. Fabricate lower running flanges with 2 degrees taper to center trolley within track. Flat, non-centering tracks are not acceptable.
 - b. Splice joint: Provide truss splice plates, channel-shaped track splice joint, bolts, lockwashers, and nuts for joining runway sections.

4. Bridge: Single girder, Vierendeel truss fabricated from rectangular steel tubes and enclosed steel box track.
 - c. Track serves as bottom cord of bridge and permits hoist trolley and festoon carriers to ride on lower inside flanges.
 - d. Fabricate track lower running flanges with 2 degrees taper to center trolley within track. Flat, non-centering tracks are not acceptable.
5. End trucks: Rigid frame end truck designed to ride inside enclosed runway track and connect to and suspend bridge.
 - a. Construction: Stamped steel fabrication with both vertical and horizontal wheels to prevent binding in runway. Designs with welds in tension are not acceptable.
 - b. Wheels: Removable, self-centering wheels with sealed lifetime lubricated bearings. Vertical wheels shall be tapered 2 degrees to match track profile. Non-removable or non-tapered wheels are not acceptable. Duracomp 4® wheel material is preferred. Steel wheels are not acceptable.
 - c. Drop lugs: Provide on both sides of truck to limit truck drop to 1 inch [25mm] maximum in event of wheel, axle, or load bar failure.
 - d. Connection to the bridge: Provide a rigid connection between bridge and end truck. Articulating connections with threaded hardware are not acceptable.
6. Hoist trolley: Rigid-body trolley designed to ride inside enclosed track of bridge and carry hoist and load. Articulating trolleys are not acceptable.
 - a. Construction: Two-piece stamped steel body with two wheels each side and tapered clevis positioning hoist hook at center of trolley so load weight is evenly distributed to all four trolley wheels. Provide removable clevis pin of type and size determined by manufacturer for specified capacity. Trolleys with non-removable clevis pins are not acceptable.
 - b. Wheels: Removable, self-centering wheels with sealed lifetime lubricated bearings. Vertical wheels shall be tapered 2 degrees to match track profile. Non-removable or non-tapered wheels are not acceptable. Duracomp 4® wheel material is preferred. Steel wheels are not acceptable.
 - c. Drop lugs: Provide on both sides of trolley to limit trolley drop to [1 inch] [25mm] maximum in event of wheel, axle, or load bar failure.
7. End stops: Molded composite, resilient bumper installed in runway and

bridge tracks to prevent end trucks, hoist trolley, and festoon carriers from rolling out of track. Bolt stops without energy absorbing bumper are not acceptable.

8. Hoist: 94876

a. **Capacity: 2 tons**

9. **Voltage: 230 V**

2.3 TRACTOR DRIVE

- A. Provide electric tractor drive for motorized operation of hoist trolley and end truck; Tractor Drive as manufactured by Gorbel, Inc.
- B. Type: Variable frequency drive assembly with worm gear reducer, molded polyurethane tread, and adjustable counter-balance to ensure proper drive wheel alignment.
- C. Speed: 70 feet [21.3] per minute.
- D. Motor: 1/3 HP, 1800 RPM, 3 phase, 208-460 volt, with thermal overload protection.
- E. Controls: 120 volt control package with transformer, terminal strips, fusing, enclosure, and mounting brackets to be field wired to drive motor.
 - a. Confirm with electrical engineer.

2.4 ACCESSORIES

- A. Provide ~~length of flat electrical cable~~ **conductor bar** to supply **electricity to** lifting device ~~and festoon along bridge and runway.~~
- B. ~~Festoon trolleys: Four wheeled trolleys with pivoting saddle and U-bolt clamp to support electrical cable on runway or bridge and allowing festooning as end truck or hoist trolley travels.~~
- ~~C. Festoon clamp: Steel clamp assembly attached to track to prevent festoon trolleys exiting track.~~

2.5 SHOP FINISHING

- A. Steam wash steel crane components with iron phosphate solution and apply baked enamel finish. Colors shall be:
 - 1. Hanger assemblies and runways: Blue. Other colors available upon request.
 - 2. Bridge: Yellow. Other colors available upon request.

- B. Provide spray cans of matching colors, air-drying paint for field touch-up. Blue and yellow only.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate provision of crane with:
 - 1. Design and construction of overhead steel framing to receive ceiling mounted crane and sway bracing as detailed on Drawings and specified in other sections. Ensure that accurate crane applied forces are provided for structural support design.
 - 2. Provision of electrical supply, conduit, wiring, and other electrical components for powering [motorized tractor drives] electrically operated lifting device.
- B. Prior to installation:
 - 1. Verify overhead support structure is ready to receive ceiling mounted work station bridge crane.
 - 2. Verify type and location of power supply.
 - 3. Inventory parts. Verify all required components are available and undamaged.

3.2 INSTALLATION

- A. Install crane and accessories in accordance with manufacturer's instructions and shop drawings.
- B. Do not modify crane components in any manner without advance, written approval from crane manufacturer.
- C. Clearances for moving crane components:
 - 1. 3 inch minimum vertical clearance from any overhead obstruction.
 - 2. 2 inch minimum horizontal clearance from any lateral obstruction.
- D. Tighten mounting bolts to manufacturer recommended torque ratings.
- E. Mark hanger placement on overhead support structure and on runways in accordance with shop drawings.
- F. Sway brace fittings: Attach to runways at locations indicated on drawings and installation manual.

- G. B7 Alloy threaded suspension rod hanger assemblies: Assemble upper hanger bracket and bolt beam clips to steel support beams. Shim as required to ensure hanger is plumb. Attach lower hanger brackets to runways.
- H. Lift runways into place and temporarily support. Connect threaded rod on upper hanger bracket to lower bracket. Ensure two minimum threads are beyond hexnut and rods are plumb and not bent.
- I. Flush mounted hanger assemblies: Bolt onto runways.
- J. Lift runways into place and temporarily support. Bolt hanger beam clips to support beams.
- K. Prior to torquing bolts, ensure runways are accurately spaced and:
 - 1. Level to within plus or minus 1/8 inch in 20 feet.
 - 2. Parallel with opposite runway to within plus or minus 1/8 inch in 20 feet.
 - 3. Track splice transitions are smooth with no raised areas to inhibit end truck operation.
- L. End stops: Bolt stops into runway track end opposite festooning end.
- M. End trucks: Mount bracket and drive to end truck. Slide one end truck onto festooning end of bridge track and clamp firmly into place. Slide other non-clamping truck onto end opposite festooning end (do not clamp this end truck into place).
- N. Prior to installing bridge, use clean dry cloth to clean inside flanges of runway and bridge tracks. Bolt end stop in bridge track opposite festooning end.
- O. Bridge: Lift bridge with end trucks to runways and insert end trucks into open ends of runways. Roll bridge down length of runway. Verify and adjust for smooth travel.
- P. Hoist trolley: Attach lifting device to hoist trolley saddle clevis. Secure clevis pin with cotter pin. Roll hoist trolley into open end of bridge track.
- Q. Hoist trolley tractor drive: Insert tractor drive into bridge track such that tow arm faces hoist trolley drive bracket. Adjust drive counterweight so drive frame hangs level from track. Adjust drive wheel to contact underside of top surface of track. Position trolley up to tractor drive and install self locking pin connecting tow arm to bracket on trolley.
- ~~R. Festoon stack section: Install section to end of runway track. Use leveling screws to align section and runway track. Position end stop and make welded connection as indicated on shop drawings.~~

- ~~_____ S. Festoon system: Install on runway and bridge.~~
- ~~_____ 1. Bolt festoon clamps to enclosed tracks. Slide festoon trolleys through open end of tracks. Thread electrical cable through festoon trolleys.~~
- ~~_____ 2. Equally space trolleys along track and secure cable with clamps.~~
- ~~_____ a. Runway: 72 inch [1829mm] spacing.~~
- ~~_____ b. Bridge: 36 inch [914mm] spacing.~~
- T. Make electrical connections from tractor drive to power source and install controls.

3.3 FIELD QUALITY CONTROL

- A. Move bridge and hoist trolley through entire travel to ensure crane is clear of obstructions and moves freely and smoothly.
- B. Inspect installed crane. Verify all bolts are tight and lock washers fully compressed.
- C. Field test crane and accessories for operating functions. Ensure crane movement is smooth and proper. [Verify motorized operation and controls function properly.] Adjust as required and correct deficiencies.
- D. Clean surfaces. If necessary, touch-up paint damage, scratches, and blemishes with manufacturer provided matching paint.
- E. Protect crane from other construction operations.

3.4 DEMONSTRATING AND TRAINING

- A. In accordance with Section 01 79 00 – Demonstration and Training, provide demonstration and training session for Owner's representative covering operation and maintenance of ceiling mounted work station bridge crane.

END OF SECTION

SECTION 41 67 20 - FALL ARREST ANCHOR SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Monorail fall arrest anchor system consisting of rigid, overhead mounted, enclosed track rail and wheeled tether trolleys.
- B. Related sections:
 - 1. Section 133419 "Metal Building Systems" for engineered metal building system designed to support fall arrest anchor system and live loads.
 - 2. **Section 412246 "Ceiling Mounted Work Station Bridge Crane" for bridge crane system that fall arrest system may be combined with.**

1.2 REFERENCES

- A. American Institute of Steel Construction (AISC): Manual of Steel Construction, Part 5, Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.
- B. American National Standards Institute (ANSI):
 - 1. ANSI Z359 - Fall Protection Code.
- C. American Society for Testing and Materials (ASTM) Publications:
 - 1. ASTM A36 - Carbon Structural Steel.
 - 2. ASTM A325 - Structural Bolts, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength.
 - 3. ASTM A490 - Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
- D. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code.
- E. Occupational Safety and Health Administration (OSHA): OSHA Specification 1926 Subpart M - Fall Protection.

1.3 PERFORMANCE REQUIREMENTS

- A. Fall arrest anchor system in conjunction with connectors and harnesses provided by others shall provide a means of protecting worker from fall in elevated work environments while providing for worker mobility to perform tasks.

- B. System shall be overhead suspended, monorail type interior installation providing protection for area indicated on Drawings.
 - 1. Bridge system if combined with work station crane.**
- C. Installed track with tether trolleys shall be positioned at height indicated on drawings and should be straight and level to eliminate potential binding or drift.
- D. Fall arrest anchor system shall be designed to support multiple workers each weighing up to 310 pounds with tools.
- E. Anchor system shall support full impact of falls vertically and at inclines up to 30 degree angle.
- F. System and components shall be rated for 900 pounds maximum arresting force (MAF).
- G. Modular, pre-engineered design: Fall arrest anchor system shall be capable of expansion, disassembly, and relocation.
- H. Tether track: Enclosed type limiting dust and dirt collection on rolling surfaces.

1.4 SUBMITTALS

- A. Provide in accordance with Section 01 33 00 - Submittal Procedures:
 - 1. Product data for fall arrest anchor system and accessories. Describe materials, capacities, performance, and operation.
 - 2. Shop drawings showing system layout, configuration, dimensions, connections, supports, and fabrication and installation details.
 - 3. Design loads: Calculations of loads transmitted from fall arrest anchor system to supporting structure.
 - 4. Copy of warranty required by Paragraph 1.6 for review by Architect.
 - 5. Manufacturer's installation and maintenance instructions.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in designing and manufacturing overhead rail systems and lifting devices with 25 years successful experience.
- B. Fall arrest anchor system shall be designed, fabricated, and installed in accordance with ANSI Z359 and OSHA 1926, Subpart M.
- C. Perform welding by certified operators in accordance with AWS D14.1.

- D. Bolted connections shall be in accordance with torque tightening procedures specified in AISC Manual, Part 5.

1.6 WARRANTY

- A. Provide under provisions of Section 01780 - Closeout Submittals:
 - 1. 5 years warranty for fall arrest anchor system to cover defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Gorbelt, Inc., P.O. Box 593, Fishers, New York 14453-0593; 800-821-0086; www.gorbelt.com.
- B. Requests to use equivalent products of other manufacturers shall be submitted in accordance with Section 01 25 13 - Product Substitution Procedures.

2.2 FALL ARREST ANCHOR SYSTEM

- A. Type: Fall arrest anchor system consisting of rigid, overhead mounted, enclosed track rail and wheeled tether trolleys designed to protect workers from falls in elevated work environments; Tether Track Rigid Rail Anchor System as manufactured by Gorbelt, Inc. Wire rope anchor systems are not acceptable.
- B. Configuration: Monorail system designed to provide worker mobility along a single straight line axis.
- C. Layout: As indicated and dimensioned on Drawings and reviewed shop drawings.
- D. Number of workers each weighing no more than 310 pounds with tools to be supported: 2.
 - 1. **If combined with bridge crane, provide separate bridge for each worker, one on each side of crane bridge.**
- E. ~~Maximum~~ Distance between track supports: ~~48 feet.~~ **17 feet 9 inches.**
- F. ~~Maximum~~ Track cantilever: ~~4'-6"~~ **1 foot 9 inches.**
- G. **Track Length: 110 feet.**

2.3 COMPONENTS

- A. Tether track: Cold-rolled steel, enclosed track designed to accommodate

easy, smooth movement without forcing or jamming of tether trolley with attached connector and to effortlessly follow worker.

1. Profile: Rectangular, tubular section with continuous bottom slot to allow movement of trolley and connector. Bottom running flanges to have 2 degree taper to keep trolley centered. Flat, non-centering tracks are not acceptable.
- B. Fall arrest rails: Truss fabricated from tubular steel sections with tether track used as bottom cord; Trussed Tether Track, Model F500SLX as manufactured by Gorbel, Inc.
- C. Tether trolleys: Wheeled, steel fabrication designed specifically to use with tether track specified in Paragraph 2.3.A for fall arrest systems and provide fluid movement and stability; Tether Trolleys as manufactured by Gorbel, Inc.
2. Wheels: Equip each trolley with 3 pairs of wheels sized to roll within tether track.
 - a. Material: DURACOMP4 as provided Gorbel, Inc.
 - b. Profile: Provide wheels with 2 degree taper to match taper of tether track.
3. Connection device: Equip bottom of trolley with swivel eye for securing shock-absorbing lanyard or self-retracting lifeline and which allows free movement beneath trolley and prevents twisting of the connector.

D. Recovery Trolley

- E. **Bridge for fall arrest bridge system: Extruded aluminum beam with tether track enclosed profile as specified in Paragraph 2.3.A.1 for bottom flange.**
 1. **Maximum span between supporting side trolleys: 12 feet 6 inches**
 2. **Length: 14 feet 6 inches**
 3. **Finish: Aluminum mill finish.**
 4. **Hardware: Equip ends of aluminum bridge with means for attachment to side trolleys.**

2.4 ACCESSORIES

- A. Provide fall arrest anchor system with end stops, splices, connecting devices, fasteners, anchors, and other hardware and accessories as required for a complete, secure, structurally sound, safe installation as indicated on Drawings and reviewed shop drawings.

- B. Design and provide attachment or suspension system for overhead mounted fall arrest anchor system including anchors, brackets, clamps, fasteners, suspension assemblies, fittings, auxiliary framing, bracing, and other components for complete, functional installation.

2.5 SHOP FINISHING

- A. Steam wash steel components with iron phosphate solution and apply baked enamel finish. Colors shall be as selected by Architect from manufacturer's full range.
- B. Provide spray cans of matching colors, air-drying paint for field touch-up.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate provision of fall arrest anchor system with:
 - 1. Provision of fall arrest harnesses and connectors provided by others. Ensure that attachment of connectors is compatible with tether trolleys being provided.
 - 2. Design and installation of structural framing for overhead support of fall arrest anchor system as specified in Section 133419 "Metal Building Systems".
 - a. Verify that structure, spacing, and bracing of supports are compatible with structural capacities of fall arrest rails.
 - b. Verify that connections of fall arrest rails to overhead mounted supports have been adequately designed and that required anchors, fasteners, and other hardware has been provided.
- B. Prior to installation:
 - 1. Verify support structure is ready to receive fall arrest anchor system.
 - 2. Inventory parts. Verify all required components are available and undamaged.

3.2 INSTALLATION

- A. Install fall arrest anchor system in accordance with manufacturer's instructions and reviewed shop drawings.
- B. Do not modify system components in any manner without advance, written approval from system manufacturer.
- C. Rigidly attach fall arrest rails to overhead structural steel framing with

clamps, brackets, bolts, and other fittings as detailed on reviewed shop drawings.

- D. Install fall arrest rails with threaded suspension rod hanger assemblies as detailed on reviewed shop drawings. Attach upper hanger bracket to steel support framing and attach lower hanger brackets to rails. Lift rails into place and temporarily support. Connect threaded rods to upper and lower bracket. Ensure two minimum threads are beyond hexnut and rods are plumb and not bent.
- E. Install auxiliary bracing as required to prevent lateral and longitude sway and movement of system as detailed on Drawings and reviewed shop drawings.
- F. Prior to torquing bolts, ensure rails are:
 - 1. Accurately spaced and level.
 - 2. Tether track splice transitions are smooth with no raised areas to inhibit movement of trolley.
- G. Tighten mounting bolts to manufacturer recommended torque ratings.
- H. Tether trolleys: Insert into fall arrest track [and bridge rail] in quantities and at locations indicated on Drawings and reviewed shop drawings.
- I. End stops: Bolt stops into open ends of fall arrest track [and bridge rail] in accordance with manufacturer's instructions and reviewed shop drawings.

3.3 FIELD QUALITY CONTROL

- A. Move tether trolleys through entire travel to ensure system is clear of obstructions and trolleys move freely and smoothly.
- B. Inspect installed fall arrest anchor system. Verify all bolts are tight and lockwashers fully compressed.
- C. Field test system with connector and simulated load attached to swivel eye of tether trolley. Ensure system operates functionally, safely, and smoothly. Adjust as required and correct deficiencies.
- D. Clean surfaces. If necessary, touch-up paint damage, scratches, and blemishes with manufacturer provided matching paint.
- E. Protect fall arrest anchor system from other construction operations.

3.4 DEMONSTRATING AND TRAINING

- A. In accordance with Section 01 79 00 - Demonstration and Training, provide demonstration and training session for Owner's representative covering operation and maintenance of fall arrest anchor system.

END OF SECTION 416720

Washoe County School District Transportation Yard Modernization

CDS Project No. 202211



Bid Set Project Manual Phase 3

***1980 Kleppe Lane
Sparks, NV 89431
20 September, 2024***

COLLABORATIVE
DESIGN
STUDIO *architecture of experience and place*

WCSD Central Transportation Yard Modifications - Sparks, Nevada
Collaborative Design Studio Project No. 202211

BID SET
15 August, 2024

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SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of buildings and site improvements.
 - 2. Removing below-grade construction.
 - 3. Disconnecting, capping or sealing, and removing site utilities.
 - 4. Salvaging items for reuse by Owner.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for use of the premises and phasing requirements.
 - 2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
 - 3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.
 - 5. Review procedures for dust control.
 - 6. Review procedures for protection of adjacent buildings.
 - 7. Review items to be salvaged and returned to Owner.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.
- C. Schedule of Building Demolition Activities: Indicate the following:
 - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - 2. Temporary interruption of utility services.
 - 3. Shutoff and capping or re-routing of utility services.
- D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

1.7 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before building demolition, Owner will remove the following items:
 - a. Equipment scheduled for reuse.
- D. Hazardous Materials: Present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.

2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.

E. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

2.2 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- D. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Salvaged Items: Comply with the following:
 1. Clean salvaged items of dirt and demolition debris.

2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
 1. Arrange to shut off utilities with utility companies.
 2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 3. Cut off pipe or conduit to the mainline. Cap, valve, or plug and seal at the mainline according to requirements of authorities having jurisdiction.
 4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."
 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.5 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain fire watch during and for duration required by AHJ after flame-cutting operations.
 - 3. Maintain adequate ventilation when using cutting torches.
 - 4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
 - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Explosives: Use of explosives is not permitted.

3.6 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated on Drawings, including, but not limited to:
 - 1. Exterior round concrete patio table and benches with associated plaque.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, completely.
- E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

3.7 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Do not burn demolished materials.

3.10 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - 1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 260001 – 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. 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.
 - 3. Provide meters, switchboards, panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system.
 - 4. Complete lighting system.
 - 5. Complete communication system.
 - 6. Complete Audio/Visual system.
 - 7. Connection of all appliances and equipment including Owner furnished equipment.
 - 8. Complete grounding system.

- 9. Complete temporary facilities for construction power.
- 10. 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: 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.
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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. Basis-of-Design Products: Where Specifications name a product, or refer to a product indicated on Drawings, and include a manufacturer or list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements

in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers or a comparable substitution.

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 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 260001

SECTION 260002 – 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 copies 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.

F. Summary of Project Closeout Items for Owner

1. Certificates of inspection and approval from authorities having jurisdiction.
2. Executed Guarantees and Product Warranties.
3. "Record" drawings.
4. Final shop drawings.
5. Final Erection drawings.
6. 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 260002

SECTION 260003 – 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.

3.2 SERVICE CONNECTION

- A. Obtain temporary service from Nevada 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.
 - 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 260003

SECTION 260503 – 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 260503

SECTION 260519 – 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.
- 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.

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- 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. Install wiring so conductors are not in tension in completed system.

- F. Form wiring neatly and group in circuit. Tie grouped conductors with nylon ties, T&B "Tyrap" or approved equivalent.
- G. Each conduit run shall be run complete end to end before conductors are installed.
- H. 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.
- I. 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.
- J. 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.
- K. 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
- L. Join and terminate copper conductors individually. Do not mix voltages in the same raceway.
- M. Provide lugs where not furnished as part of equipment - furnish as specified above, to connect all conductors.
- N. Furnish lugs for conductors #1/0 and larger with two bolt tongue or accepted equivalent single bolt tongue with anti-turn devices.
- O. 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.
- P. 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.
- Q. 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.
- R. DO NOT COMBINE CIRCUITS into more than three circuits per homerun unless specifically approved by the Consultant.
- S. Neutral conductors shall not be used for equipment grounding.
- T. Circuitry shall not be run in elevator shafts and hoistways.

- U. Provide a separate neutral and grounding conductor for all GFI circuits or GFI devices to ensure an adequate ground-fault return path.

V. Conductors for receptacle and lighting circuits shall be installed in accordance with the following conditions:

Maximum one-way circuit length in feet for 90°C copper conductors with unity power factor to first device on circuit. Assumed 1920VA/120V, 4432VA/277V loading per circuit.

1. 120V – Single Phase
 - a. #12AWG – 53'
 - b. #10AWG – 88'
 - c. #8AWG – 138'
 - d. #6 AWG – 223'
2. 277V – Single Phase
 - a. #12AWG – 123'
 - b. #10AWG – 205'
 - c. #8AWG – 319'
 - d. #6AWG – 515'

- W. Panelboards may not be used as raceways.
- X. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- Y. Install terminal lugs on ends of 600-volt wires unless lugs are furnished on connected device, such as circuit breakers.
- Z. 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.
- AA. 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.
- BB. Clean conductor surfaces before installing lugs and connectors.
- CC. 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 260519

SECTION 260526 – 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: 8 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 260529 – 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.
- B. Related Sections:
 - 1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.

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.**

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 260529

SECTION 260533 – 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.

- 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 $\frac{3}{4}$ " conduit. Conduit not allowed to be run within slab on grade.
- D. Outdoor Locations, Above Grade: Provide rigid steel conduit and electrical metallic tubing. 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 $\frac{3}{4}$ " conduit. 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.

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 fer alloy. 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. Exterior buried conduit shall be scheduled 40 PVC with PVC coated RGS 90 degree bends when penetrating through floor slabs.
- Z. Use rigid steel conduit for all motor circuits where subject to physical damage.
- AA. Intermediate grade metal conduit, (threaded only), may be used in lieu of rigid steel conduit where allowed by NEC.
- BB. 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'.
- CC. 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.
- DD. EMT shall not be installed underground and shall not be encased in concrete.
- EE. Conduit must be installed high enough above lay in ceiling to permit removal of ceiling panels and light fixtures.
- FF. 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.
- GG. In accordance with NEC 300.4 conduit may not be run exposed across roof.
- HH. 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.
- II. Route underground conduits minimum 24" below grade.
- JJ. Paint conduit threads exposed to moisture with exterior grade, rust preventive silver paint after installation.
- KK. 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.
- LL. Vibrating equipment and equipment requiring adjustment, i.e.: motors, transformers, etc: make final connections with flexible metal conduit.
- MM. 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.
- NN. 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.
- OO. All conduit penetrations through or within CMU walls shall be rigid steel. Conduit run within CMU walls encased in concrete shall be PVC.

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. Where outlet boxes are installed in unfinished concrete walls or columns, provide 1" deep plaster ring with box and ring set in position before the concrete is poured so concrete will fill around the ring and cover plate can be installed flush with the

unfinished surface. In case of brick walls, follow same procedure with mason filling around the plaster ring with mortar.

- S. Install all outlets located on columns or walls, provide 6" x 6" x 3" deep wood box placed in the forms before concrete is poured. Remove wood box before waterproofing is applied. General Contractor will waterproof wall and opening, after which Electrical Contractor will install outlet box. General Contractor will grout around box. Set boxes carefully so that cover plates will be flush with the surface and square.
- T. **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. See 1/S021.**

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 260533

SECTION 260553 – 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 260553

SECTION 262716 - 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 262716

SECTION 262726 – 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 $\pm 0.005\%$ tolerance, 32 kHz within $\pm 0.002\%$ tolerance, or 40 kHz $\pm 0.002\%$ 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 or match existing, nylon. Provide red device for receptacles on standby emergency power.
- 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 or to match existing. Provide red cover/plate for red receptacle unless noted otherwise.
- C. Jumbo Cover Plate: White or to match existing.
- D. Weatherproof Cover Plate: Gasketed cast metal plate with hinged and gasketed device cover. 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.

2.5 MODULAR RECEPTACLE

- A. Manufacturers:
 - 1. Cooper – Arrow Link.
 - 2. Leviton – Lev-Lok.
 - 3. Hubbel – SNAPConnect.
 - 4. Legrand – PlugTail.
 - 5. Substitutions: Not Permitted.
- B. Description:

Manufactured UL Assembly, 20Amp, 120V, heavy duty, locking type straight blade or twist on modular connector with or without pigtails.

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 262726

SECTION 265600 - 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. 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 all exterior lighting fixtures and poles with tags consistent with the University's standard naming convention. 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 and submitted to the Electric Shop.

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.

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: Provide in areas of consistent, high, uneven winds.

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 265600

SECTION 266000 – 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. Six copies of 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

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).

END OF SECTION 266000

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 51 13: Paging 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.
C.	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. 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.
- B. Spare conduits shall be plugged with expandable plugs.
- C. 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 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 Concrete Hand Holes and Covers 10" Wide x 17" Long (Non Traffic Rated).
 - 3. Precast Concrete Hand Holes and Covers 13" Wide X 24" Long (Non Traffic Rated).
 - 4. Precast Concrete Pull Boxes and Covers 17" Wide X 30" Long (Non Traffic Rated).
 - 5. Precast Concrete Pull Boxes and Covers 17" Wide X 30" Long (H-20 Traffic Rated).
 - 6. Precast Concrete Pull Boxes and Covers 30" Wide X 48" Long (Incidental H-20 Traffic Rated).
 - 7. Precast Concrete Pull Boxes and Covers 36" Wide X 60" Long (H-20 Traffic Rated).
 - 8. Multi-cell fabric innerduct.
 - 9. Pull rope.
 - 10. 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 01 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 Concrete Hand Holes and Covers 10" Wide x 17" Long (Non Traffic Rated).
 3. Precast Concrete Hand Holes and Covers 13" Wide X 24" Long (Non Traffic Rated).
 4. Precast Concrete Pull Boxes and Covers 17" Wide X 30" Long (Non Traffic Rated).
 5. Precast Concrete Pull Boxes and Covers 17" Wide X 30" Long (H-20 Traffic Rated).
 6. Precast Concrete Pull Boxes and Covers 30" Wide X 48" Long (Incidental H-20 Traffic Rated).
 7. Multi-cell fabric innerduct.
 8. 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. Certaineed 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 IDF.

- B. Provide qty (1) 2" 3-Cell MaxCell fabric innerduct "packs" in each 2" conduit between the MDF and the IDF's.
- C. The MaxCell innerduct shall be terminated at the entry point of the telecom rooms and secured to the plywood backboard. 1 1/4" non-split orange corrugated innerduct shall be installed to route fiber optic backbone cabling from this point to the fiber termination cabinet(s).
- D. Acceptable Products:
 - 1. MaxCell Edge 2" 3-Cell Part Number MXE52223xx1000 (for installation in 2" conduits).
 - 2. No Substitutions accepted.

2.4 PULL ROPE

- A. Pull rope shall be installed within each outside plant conduit and within each innerduct.
- B. Pull rope 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 pull rope with sequential foot markings.

2.1 TELECOM HAND HOLES AND COVERS (10" WIDE X 17" LONG) NON-TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.
- B. Provide 10" wide x 17" long x 12" deep reinforced concrete pull box.
- C. Provide qty (2) 10" wide x 17" long x 12" deep reinforced concrete extensions.
- D. Provide reinforced concrete lockable bolt down lid.
- E. Provide additional reinforced concrete extensions as required to maintain conduit depth as shown on the drawings.
- F. Acceptable Products:
 - 1. Jensen Precast HN1017-B pull box, HN1017-E Extension and HN1017-L01 Lid.
 - 2. Or Approved Equal.

2.2 TELECOM HAND HOLES AND COVERS (13" WIDE X 24" LONG) NON-TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.

- B. Provide 13" wide x 24" long x 12" deep reinforced concrete pull box.
- C. Provide qty (2) 13" wide x 24" long x 12" deep reinforced concrete extensions.
- D. Provide reinforced concrete lid.
- E. Provide additional reinforced concrete extensions as required to maintain conduit depth as shown on the drawings.
- F. Acceptable Products:
 - 1. Jensen Precast HN1324 pull box, HN1324-E extension and HN1324-L02 Lid.
 - 2. Or Approved Equal.

2.3 TELECOM PULL BOXES AND COVERS (17" WIDE X 30" LONG) NON-TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.
- B. Provide 17" wide x 30" long x 12" deep reinforced concrete pull box.
- C. Provide qty (2) 17" wide x 30" long x 12" deep reinforced concrete extensions.
- D. Provide reinforced concrete lockable bolt down lid.
- E. Provide additional reinforced concrete extensions as required to maintain conduit depth as shown on the drawings.
- F. Acceptable Products:
 - 1. Jensen Precast HN1730-B pull box, HN1730-E extension and HN1730-L01 Lid.
 - 2. Or Approved Equal.

2.4 TELECOM PULL BOXES AND COVERS (17" WIDE X 30" LONG) H-20 TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.
- B. Pull boxes, risers and lids shall be H-20 traffic rated.
- C. Provide 17" wide x 30" long x 12" deep reinforced concrete pull box.
- D. Provide 17" wide x 30" long x 12" deep reinforced concrete extensions.
- E. Provide steel diamond plate bolt down lid.

- F. Provide additional reinforced concrete risers as required to maintain conduit depth as shown on the drawings.
- G. Acceptable Products:
 - 1. Jensen Precast HT1730-B pull box, HT1730-E extension and HT1730-L-11-01 Lid.
 - 2. Or Approved Equal.

2.5 TELECOM INTERCEPT PULL BOXES AND COVERS (30" WIDE X 48" LONG)
INCIDENTAL H-20 TRAFFIC RATED

- A. Provide reinforced precast concrete telecom pull boxes where shown on the drawings.
- B. Provide 30" wide x 48" long x 30" deep reinforced concrete intercept pull box with 4" deep base.
- C. Provide 30" wide x 48" long x 12" deep reinforced concrete riser.
- D. Provide split incidental H-20 steel bolt down diamond plate surface. Covers shall be labeled "COMMUNICATIONS".
- E. Provide corrosion resistant galvanized steel channel racking and cable support hooks in all pull boxes. Racking and cable support hooks shall be installed on both sides of each pull box.
- F. Acceptable Products:
 - 1. Jensen Precast PB3048-I intercept pull box (PB3048-I), 12" Riser RS304812 and incidental H-20 Cover CA3048C61.
 - 2. Or Approved Equal.

PART 3 – EXECUTION

3.1 UTILITY COORDINATION

- A. Contact local utility companies and utility locating services prior to excavation to locate and mark existing underground utilities.
- B. Coordinate conduit routing with existing underground utilities. Reroute conduit and provide horizontal and vertical offsets as required to avoid and to provide necessary clearances from existing utilities.

3.2 CONDUIT

- A. OSP conduits shall be installed with a slight drain slope (0.125 inches-per-foot) away from buildings to prevent the accumulation of water in the conduit or ingress to the buildings.
- B. Factory-manufactured sweeps which meet ANSI/TIA-569-B bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable.
- C. Any 4" conduit with a sweep of more than 11 degrees is to have a minimum concrete encasement of 4".
- D. OSP conduits shall be installed a minimum of 48" below finished grade. Conduits shall be encased in hard-tamped sand a minimum of 6" above and below the conduits. 6" clear space shall be maintained between conduits. Backfill above the conduits shall be installed and compacted to 95% density.
- E. OSP conduit and duct bank runs must have a continuous orange colored, metal detectable warning tape installed half the distance between the top of the conduit and the finished grade.
- F. All cable shall be installed in the lowest available conduit in a duct bank, working up as additional cables are installed.
- G. Prior to installing cables, all new or unused OSP conduits must be cleaned with a brush pulled through the conduit at least two times in the same direction and swabbed with clean rags until the rag comes out of the conduit clean and dry. Conduits shall then be tested with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run.
- H. Spare OSP conduits and innerducts shall be plugged with watertight plugs at both ends to prevent the intrusion of moisture, gasses, and rodents throughout the construction project.
- I. All OSP conduits and innerduct shall have a 3/8" nylon pull rope installed. Pull rope shall be re-pulled each time an additional cable is installed.

3.3 PULL BOXES

- A. Install pull boxes and set covers to match finished grade.
- B. Conduits shall enter pull boxes from the side. Do not sweep conduits into the bottom of the pull box.

3.4 CUTTING AND PATCHING

- A. Sawcut and remove existing pavement, sidewalks, gutters, etc., to accommodate installation of outside plant conduit and pull boxes.

- B. Replace sub-base, pavement, sidewalks gutters, etc., to match existing.
- C. Repair and replace all landscaping and sitework disturbed by excavation including but not limited to irrigation lines, lawns, planting, etc. Resod lawn areas disturbed by excavation.

END OF SECTION 270543

SECTION 270800 – COMMISSIONING OF COMMUNICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the testing, labeling and documentation of the telecom cabling system in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.
- C. This section includes the minimum requirements for the testing, identification and administration for the telecommunications cabling system, including the following:
 - 1. Testing
 - a. Category 6 Cable Test Equipment and Test Procedures.
 - b. Category 6A Cable Test Equipment and Test Procedures.
 - c. Copper backbone cable test equipment and test procedures.
 - d. Fiber optic cable test equipment and test procedures.
 - e. Cable test reports.
 - 2. Identification
 - a. Labeling of work area outlet faceplates and jacks.
 - b. Labeling of horizontal data, voice and video cabling.
 - c. Labeling of Copper Patch Panels.
 - d. Labeling of fiber optic patch panels.
 - e. Labeling of 110 wiring blocks.
 - f. Labeling of racks and cabinets.
 - g. Labeling of copper and fiber backbone cable.
 - h. Labeling of innerduct.
 - 3. Administration
 - a. As-built drawings.
 - b. Materials listing.

1.2 RELATED SECTIONS

- A. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
- B. Related Sections:
 - 1. 27 05 00: Common Work Results for Communications.
 - 2. 27 11 00: Communications Equipment Room Fittings
 - 3. 27 13 00: Communications Backbone Cabling

4. 27 15 00: Communications Horizontal Cabling

- 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 01 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. 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. Cable tester shall comply with the requirements of ANSI/TIA-1152.
- B. Cable tester shall perform all tests necessary to certify the horizontal Category 6 UTP cabling in accordance with ANSI/TIA 568 C.2.
- C. 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.
- D. Acceptable Manufacturers
 - 1. Fluke Networks
 - 2. Ideal Industries
 - 3. Agilent Wirescope
 - 4. AEM
 - 5. Softing/WireXpert
 - 6. Trend Networks.
 - 7. Or equal.

2.2 CATEGORY 6A (AUGMENTED) UNSHIELDED TWISTED-PAIR CABLE TESTER

- A. Cable tester shall comply with the requirements of ANSI/TIA-1152.
- B. Cable tester shall perform all copper UTP Cat 6A CMP-rated cable with tester set-up to identify the cable manufacturer with associated NVP as well as the connectivity manufacturer.
- C. Shall be a UL certified Level IIIe test set calibrated by a manufacturer certified calibration facility.
- D. The software calibration date shall be current throughout the testing phase of the project and be stated in the test results documentation or, by hard copy from the manufacturer.
- E. The tester set-up should include the application to support 10GBase-T (IEEE 802.3an).
- F. Test results shall be in PDF format and, if requested, manufacturer proprietary software.
- G. Acceptable Manufacturers
 - 1. Fluke Networks
 - 2. Ideal Industries
 - 3. Agilent Wirescope
 - 4. AEM
 - 5. Softing/WireXpert
 - 6. Trend Networks.

7. Or equal.

2.3 SINGLEMODE OPTICAL FIBER CABLE TESTER

- A. Tier 1 certification is defined as the measurement of the total insertion loss, length, and polarity of the optical cable cabling from one end of the link to the other. The test equipment used is a 'combined' optical power meter and light source called an OLTS or Optical Loss Test Set.
- B. Test Reference Cables (TRCs) minimum standards; 2.8-3.0 OD jacketing, zirconia ceramic UPC LC ferrule < 0.25 dB IL (insertion loss) and > 0.50 RL (reflection loss).
- C. Tier 2 optical fiber testing includes Tier 1 OLTS testing and is used to define the graphical precise characterization of the fiber link. The tester used for Tier 2 testing is an OTDR or Optical Time Domain Reflectometer.
- D. When using an OTDR, use only high-quality, low-loss, dual launch boxes having the same optical cable and connectors being tested and are required at both transmit and receiving ends.
- E. Both Tier 1 and Tier 2 testing shall be bi-directional and dual wavelengths (1310 & 1550 nm).
- F. The tester shall be capable of performing the tests required by ANSI/TIA-568.1-E, ANSI/TIA-568.3-D, ANSI/TIA-526-7A and TR 42.11.
- G. The software calibration date shall be current throughout the testing phase of the project and be stated in the test results documentation or by hard copy from the manufacturer.
- H. The tester set-up should include the application to support QSFP28-100GBase-LR4 (IEEE 802.3 bm).
- I. Acceptable Manufacturers
 1. Agilent Wirescope
 2. AEM
 3. AFL
 4. EXFO
 5. FIS
 6. Fluke Networks
 7. Fujikura
 8. Ideal Industries
 9. Jonard
 10. Softing/WireXpert
 11. VIAVI
 12. Or equal.

2.4 LABELS

- A. Labels shall be laser printed and shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.
- B. Acceptable manufacturers
 - 1. Belden
 - 2. Brady
 - 3. Brother
 - 4. HellermannTyton.
 - 5. Or approved equal

2.5 WORK AREA OUTLET FACEPLATE LABELS

- A. Label each port in each faceplate in accordance with Labeling Scheme identified on the Drawings. Label must be machine printed and inserted in the faceplate label window. Labels shall be provided by the faceplate manufacturer of the faceplate.
- B. Acceptable manufacturers
 - 1. Belden
 - 2. Brother
 - 3. HellermannTyton.
 - 4. No Substitution

2.6 HORIZONTAL CABLE SHEATH LABELS

- A. Label horizontal cable sheaths at work area outlets and at patch panels with laser printed self-laminating wrap around vinyl labels. Labels shall be in accordance with the Labeling Scheme identified in WCSD SCS-015.
- B. Labels shall be white with black type. Label size shall be 1.0" wide by 1.5" high.
- C. At the Telecom Room, cable labels will be affixed to cable a minimum of 1 inch from the termination on the patch panel, and placed in such a way as to be clearly visible.
- D. At the work area outlet, cable labels shall be affixed to the cable 2 inches from the termination on the jack.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

2.7 COPPER PATCH PANEL LABELS.

- A. Label each patch panel with a single panel ID label in accordance with the labeling scheme identified WCSD SCS-015.

- B. Labels shall be compatible with the patch panels provided for the Project.
- C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal
- D. Label each patch panel port with a laser printed label. Label each port with the room number of the room housing the work area outlet.
- E. Labels shall be compatible with the patch panels provided for the Project.
- F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.375" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

2.8 TELECOM ROOM FIBER OPTIC TERMINATION CABINET LABELS

- A. Label each fiber optic patch panel with a single panel ID label in accordance with the labeling scheme identified WCSD SCS-015.
- B. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal
- C. A label will be affixed to the fiber termination cabinet as shown using the Backbone Cable Labeling Scheme.
- D. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.

- e. Or approved equal

2.9 EQUIPMENT ROOM FIBER OPTIC TERMINATION CABINET LABELS

- A. Label each fiber termination cabinets in accordance with the labeling scheme identified in WCSD-SCS-015.
- B. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal
- C. Label fiber modules in accordance with the labeling scheme identified in WCSD-SCS-015. Labels shall be affixed to the fiber termination cabinet directly on the Plexiglas front cover so labels will be visible when the cover is closed. Each label will indicate the exact location and position of the cable's far end according to the Backbone Cable Labeling Scheme.
- D. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal
- E. Label each Connector Module with its Slot in accordance with the labeling scheme identified on the drawings.
- F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5" wide by 0.5" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

2.10 EQUIPMENT RACK LABELS

- A. Provide labels on the top angle of all equipment racks. Labels shall in accordance with the labeling scheme identified in WCSD-SCS-015.
- B. Racks shall be labeled with Space ID and Rack ID.

- C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 1.0" high.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

2.11 COPPER BACKBONE CABLE SHEATH LABELS

- A. The backbone cable sheaths in the Telecom rooms and at pull boxes shall be labeled. Labels shall be in accordance with the labeling scheme identified in WCSD-SCS-015.
- B. Labels must be clearly visible at the rear of the rack.
- C. Labels shall be self-laminating vinyl labels and must be compatible with the diameter of the backbone cable. Labels shall be 2.5" high by 1.5" wide.
 - 1. Acceptable Manufacturers:
 - a. Belden
 - b. Brady
 - c. Brother
 - d. HellermannTyton.
 - e. Or approved equal

PART 3 – EXECUTION

3.1 CABLE TESTING – GENERAL

- A. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
- B. Where post-manufacture test data has been provided by the manufacturer on the reel or shipping carton, submit copies to the Owner's Representative as part of the cable test results.
- C. The Owner's Representative reserves the right to observe any or all portions of the cable testing process.
- D. The Owner's Representative further reserves the right to conduct, using contractors equipment and labor, a random re-test of up to ten percent (10%) of the cable plant to confirm documented test results.
- E. Test results and corrective procedures are to be documented and submitted to the Owner's Representative within five (5) working days of test completion.

3.2 CATEGORY 6 UTP CABLE TESTING

- A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.
- B. Field test measurements shall be made in accordance with Annex I of TIA 568-C.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 ANSI/TIA-1152. 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 TIA 568-C.2 Annex C: "Cabling and Component Test Procedures".
- 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 TIA 568-C.2 Section 6.3.
- 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-C.2; 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 ANSI/TIA-568-C.2.
- C. Field test measurements shall be conducted from 1 MHz to 500 MHz.
- D. Field testing shall be conducted using a level IIIe tester. The accuracy of the level IIIe tester shall meet or exceed the requirements of ANSI/TIA-1152.
- E. The software calibration date shall be current throughout the testing phase of the project and be stated in the test results documentation or, by hard copy from the manufacturer.
- F. Every cabling link shall be tested to copper 100-ohm UTP Cat 6A cable with tester set-up to identify the cable manufacturer with associated NVP as well as the connectivity manufacturer.
- G. The cable must be tested to "Permanent Link" performance as defined in ANSI/TIA 568.2-D having a maximum length of 295 feet (90m).
- H. 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.

- I. 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).
- J. 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.
- K. 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
 - 2. Length
 - 3. Propagation Delay
 - 4. Delay Skew
 - 5. DC Loop Resistance
 - 6. Insertion Loss
 - 7. NEXT (Near-End Crosstalk)
 - 8. PS NEXT (Power Sum Near-End Crosstalk)
 - 9. ACR-N (Attenuation to Crosstalk Ratio Near-End)
 - 10. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
 - 11. ACR-F (Attenuation to Crosstalk Ratio Far-End)
 - 12. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
 - 13. Return Loss
- L. Test results shall be provided in electronic PDF and raw data format within 5 days after the completion of the project. Test documentation shall be saved in Fluke LinkWare file format version 11.0 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).
 - g. Date and time.
 - 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. 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.
4. 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. Once corrective measures have been taken and the failed tests passes, only retain the PASS test and discard the FAIL for final documentation.

3.4 SINGLEMODE 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 fiber strands shall be tested and must pass the field test specifications defined by the Telecommunications Industry Association (TIA) standards ANSI/TIA-568.1-E, ANSI/TIA-568.3-D and ANSI/TIA-526-7-A. Any failing fiber strands 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-526-7A. The light source shall meet the launch requirements of ANSI/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-568-1-E) with a Category 1 light source. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/TIA-526-7-A.

- 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. Test Reference Cables (TRCs) minimum standards; 2.8-3.0 OD jacketing, zirconia ceramic UPC LC ferrule < 0.25 dB IL (insertion loss) and >0.50 RL (reflection loss).
- 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. Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA-526-7-A, Method A.1, One Reference Jumper or equivalent method.
 - 2. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA-568.3-D.

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:

Wavelength	OSI (ISP)	OS1A (ISP OS2)	OS2 (OSP)
1310 nm	1.0 dB/km	0.4 dB/km	0.4 dB/km
1310 nm	0.3 dB/Mft	0.12 db/Mft	0.12 dB/Mft
1550 nm	1.0 dB/km	0.4 dB/km	0.4 dB/km
1550 nm	0.3 dB/Mft	0.12 db/Mft	0.12 dB/Mft

- 3. Maximum insertion loss (IL) per mated pair is 0.35 dB and 0.02 dB per fusion (only) splice.

- I. The Contractor shall test all fiber optic cables and provide test results in electronic PDF format signed by the technician performing the testing. The following field test documentation shall be provided for each fiber optic strand:
 1. Wavelength of test (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.

3.5 IDENTIFICATION AND LABELING

- A. The Contractor shall confirm the telecom room and work area room numbers with the Owner or Owner's Representative prior to labeling.
- B. Labeling scheme shall follow the requirements of Washoe County School District Structured Cabling Specification WCSD-SCS-015 dated October 21, 2016.
- C. Work Area Outlet Face Plates: See WCSD-SCS-015 for requirements.
- D. Work Area Data and Voice Jacks: See WCSD-SCS-015 for requirements.
- E. Work Area Horizontal Data, Voice and Video Cable: See WCSD-SCS-015 for requirements.
- F. Telecom Room Horizontal Data, Voice and Video Cable: See WCSD-SCS-015 for requirements.
- G. Patch Panels: See WCSD-SCS-015 for requirements.
- H. Patch Panel Ports: See WCSD-SCS-015 for requirements.
- I. Fiber Termination Cabinets: See WCSD-SCS-015 for requirements.
- J. 110 Blocks: See WCSD-SCS-015 for requirements.
- K. Backbone Cables: See WCSD-SCS-015 for requirements.
- L. Equipment Racks and Cabinets: See WCSD-SCS-015 for requirements.

3.6 ADMINISTRATION

A. As-Built Drawings.

1. The Contractor shall provide As-Built drawings at the end of the project in electronic PDF format. 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 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
 9. OSP CAT 6 Cable (For Parking Lot Pole Mounted Cameras)

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
 - 8. OSP CAT 6 Cable (For Parking Lot Pole Mounted Cameras)
- 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 or Cable Insertion Loss (dB)	NEXT Loss (dB)	PSNEX T 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 gym 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.

2.2 HORIZONTAL CATEGORY 6 CABLE - OUTSIDE PLANT

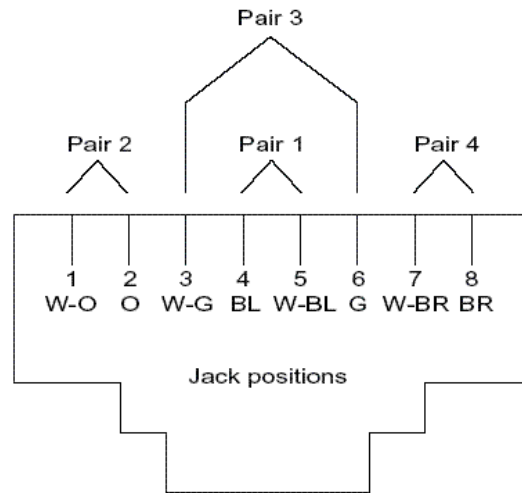
- A. Provide 4-pair CAT 6 OSP rated cabling.
- B. Cables shall be filled and flooded with a water-blocking compound. The cable shall consist of 4-pair 24 AWG insulated conductors. Cable shall be suitable for underground duct installation.
- C. Cable jacket marking: Must be legible and shall contain the following information:
 - 1. Manufacturer's name.
 - 2. Copper conductor gauge.
 - 3. Pair count.
 - 4. Manufacturer's trade mark.
 - 5. Sequential foot markings.
- D. Acceptable Products:
 - 1. Belden P/N OSP6u 01010000.
 - 2. No substitutions.

PART 3 – EXECUTION

3.1 HORIZONTAL CABLE ROUTING AND TERMINATION

- A. 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.
- B. 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.

- C. Category 6 and Category 6A cables shall be bundled separately.
- D. 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.
- E. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturers requirements and reference documents.
- F. 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.
- G. All telecom cables shall be stored in accordance with the manufacturer's requirements.
- H. 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.
- I. 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.
- J. 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.
- K. 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).
- L. Horizontal UTP pair untwist at the termination shall not exceed 0.5".
- M. 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:



- N. 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.
- O. 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.
- P. 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.
- Q. 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.
- R. When placing cable, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).
 - 1. 6" clear from power conductors.
 - 2. 12" clear from fluorescent lighting fixtures and ballasts.
 - 3. 36" clear from transformers and motors.

3.2 WORK AREA OUTLETS

- A. Work Area outlets and connectors shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

- B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer's recommendations and best industry practices.
- C. Pair untwist at the termination shall not exceed 0.5".
- D. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.

END OF SECTION 271500

SECTION 275113 – PAGING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY OF WORK

- A. This section includes a fully operational IP platform for a facility-wide internal communications:
 - 1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.
 - a. Emergency announcements that will override any pre-programmed audio.
 - b. District-wide, Emergency, Group, All School and Zone live voice paging.
 - c. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music and voice.
 - d. Web-based user interface.
 - 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 facility directly via the School District supplied SIP enabled Telephone Network.
 - 4. 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.
 - 5. Paging and two-way intercom features shall be accessible from any system console or SIP connected telephone for each campus.
 - 6. The platform shall synchronize its system time to the network timeserver or a web-based time server.
 - 7. Each single campus installation shall be locally survivable for intercom, paging, even when the district connection is unavailable.
 - 8. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.
 - 9. 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

- 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 announce 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. Visual Status Indicator Lights
1. Visual status indicator lights shall be provided at locations shown on the drawings. Lights shall have multi-color status lights and shall be programmed to display colors associated with an initiated "code" event.
- H. Equipment Racks
1. Where shown on the drawings, equipment shall be rack mounted in 4-post telecom racks (see telecom drawings).
 2. Provide dedicated paging system equipment racks where shown on the drawings.
- I. 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.

J. 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.

K. 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 have a mar/scratch baked epoxy rust inhibitive finish.

L. 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 280000 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY & 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 tiles | Space above a ceiling constructed of removable (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. The Contractor shall seal all building penetrations to prevent the intrusion of moisture.

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

280500 - 2 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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 280500

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 & Security.
 - 2. Section 28 10 00: Access Control.
 - 3. Section 28 20 00: Video Surveillance.
 - 4. 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. 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 280553 - IDENTIFICATION FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 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.

1.2 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 10 00: Access Control.
 - 4. Section 28 20 00: Video Surveillance.
 - 5. 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:
 - 6. National Electric Code (NEC), NFPA 70.

1.4 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

2.1 LABELS

A. Phenolic two tone for exterior mounting on equipment enclosures. White lettering on black background.

2.2 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

3.1 INSTALLATION

A. Physically label all of the ESS Systems components including but not limited to the following:

1. Cables:
 - a. Label at all termination points.
 - b. Label at pullboxes, junction boxes and outlet boxes.
2. Label Access Control and Intrusion Detection System Cabinets.
3. Label Field equipment cabinets.
4. Label equipment within the cabinets and enclosures indicating its function.
5. Label equipment with its IP address (where applicable).
6. Label Terminal blocks.
7. Label Relays.
8. Label Patch panels, and the termination positions within the patch panels.

- B. Identify wire and cable clearly with permanent labels wrapped about the full circumference within one (1) inch of each connection. Indicate the number designated on the associated field or shop drawings or run sheet, as applicable. Assign wire or cable designations consistently throughout a given system; i.e., each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Label cables where cable first enters and exits from conduit, junction or distribution boxes; labels shall be located within six (6) inches of the point of exit.
- C. Label all equipment mounted in the equipment enclosures indicating its function. This includes servers, switches, controllers, power supplies, batteries, etc.
- D. Components, such as racks and patch panels, must be permanently marked with machine-generated labels, according to current practices and as approved by the Owner before installation.
- E. Labels shall coincide with device id's use on the record drawings.
- F. Equipment Enclosures.
 - 1. Label all Enclosures, alarm monitoring, and powers supply enclosures associated with the security system with an adhesive backed phenolic label. Use 12 point text.
 - 2. Labels shall be represented in and match the security system record drawings.
- G. Security Devices.
 - 1. Label all equipment associated with the security system with a permanent machine generated, laminated, label. Use 12 point text with a clear background. Use white or black lettering depending upon the color of the device.
 - 2. Label device in a concealed location with the system point number and address.
 - 3. Label power supply batteries with the month and year they were installed.
- H. Wire and Cable.
 - 1. Label all wire and cable associated with the security system with permanent machine generated, laminated, labels. Use 12 point, black text on a white label.
 - 2. All wire and cable labels shall be clearly visible without the need to remove wire management or any other obstructions.

END OF SECTION 280553

SECTION 282000 – VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment, tools, transportation, storage costs, testing, training and all necessary and related items required to provide a complete and operational video surveillance system as shown on the Drawings and described in the Specifications.
- B. 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.
- ~~B. Furnish, install, mount, secure, aim, focus, adjust, connect power to, connect to the network, assign IP addresses, configure, test, commission and demonstrate all IP video surveillance cameras.~~
- ~~C. Furnish and install all necessary camera mounts and supports including ceiling mount kits, trim rings, gooseneck supports, corner mounts, pendant mounts, brackets, support arms, pole mounts, back boxes, etc. All screws and fasteners used for camera supports, raceway supports, junction boxes and pull boxes shall be vandal resistant (Torx Pin Head style).~~
- ~~D. Install CAT 6 cabling from each camera to CAT 6A patch panels as shown on the drawings. Furnish CAT 6 patch cords at the patch panel to connect the camera patch panel ports to owner furnished POE switches. NOTE—WCSD will cross connect cameras to the network switches at the Telecom Room. All CAT 6 cabling to be installed and tested in accordance with the Division 27 Specifications.~~
- ~~E. Furnish and install Milestone XProtect Corporate Version 10.x device “channel” software licenses for each new camera at each project location unless otherwise~~

~~noted. See camera schedule on the drawings for licensing requirements. Software licenses shall include a Milestone 1-year "Care Plus" Product Maintenance Agreement. Load license packs on WCSD's existing Milestone Management Server located at the East 9th Street Administration Offices and assign licenses to the camera at each project site.~~

- ~~F. Furnish, install, update and configure Milestone XProtect Corporate Version 10.x video "recording" software on the video recording server (video recording server hardware and server operating system provided and installed by WCSD).~~
- ~~G. Furnish, install, update and configure Milestone XProtect Smart Client video management software on a minimum of (3) client computers at each project location to enable users to view surveillance camera images and control cameras. Configure logical camera viewing groups and for each client computer as directed by WCSD.~~
- ~~H. Test, commission and demonstrate the entire IP video surveillance system in the presence of the Owner's Representative.~~
- ~~I. Provide a minimum of four (4) hours training to the Owner on the usage and operation of the IP video surveillance cameras, video recording server management software and client software. Training shall consist of two (2) 2-hour training sessions as scheduled by the Owner.~~

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 IP video surveillance system shall be a "Milestone Certified Partner" and shall have a Milestone Advanced Certification required to purchase and install the Milestone XProtect Corporate software.~~

~~D. The Contractor must be a Sony Security Preferred Reseller (SSPR).~~

~~E.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.

~~F.D.~~ The Contractor must be licensed by the Nevada State Contractors Board.

~~G.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 1080P dome cameras.
 - b. Outdoor fixed 4-sensor vandal resistant dome cameras.

- c. Camera supports including wall mount kits, corner mount kits, pole mount kits, gooseneck support arms, ceiling pendant kits, back boxes, etc.
- ~~d. Video Recording Software and Camera Licenses.~~
- ~~e-d.~~ CAT 6 Cabling – Indoor Plenum Rated.
- ~~f-e.~~ CAT 6A Field Mount Plugs.
- ~~g-f.~~ 48-Port CAT 6A Patch Panels.
- ~~h-g.~~ CAT 6 Patch Cords.
- ~~i-h.~~ Parking Lot Camera Powered POE Extenders.

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. _____
 - 4. All CAT 6 cables installed, terminated, labeled and tested. Certified test reports submitted to WCSD.
 - 5. All cameras properly aimed and focused as directed by WCSD IT.
 - 6. All Punchlist items completed.
 - 1. ~~All cameras mounted in accordance with the drawings.~~
 - 2. ~~All CAT 6 cables installed, terminated, labeled and tested. Certified test reports submitted to WCSD.~~
 - 3. ~~All cameras connected to the network and assigned IP addresses (WCSD to provide IP address scheme. WCSD to cross connect cameras to the network at the Telecom Room). Contractor to provide list of camera locations, hardware MAC addresses and IP addresses to WCSD.~~

4. ~~All cameras communicating and recording to the video "Recording" server.~~
5. ~~All cameras properly aimed and focused for both day and night operation.~~
6. ~~All cameras configured for proper aspect ratio, resolution, frame rate and video recording size.~~
7. ~~Video "Recording" software installed, updated and configured on the video recording server at each project location. Coordinate software installation with WCSD.~~
8. ~~The local video "Recording" server communicating with video "Management" server located at the East 9th Street Administration Offices over the wide area network.~~
9. ~~Device "channel" licenses for each camera installed on the video "Management" server.~~
10. ~~Client viewing and configuration software installed, updated and configured on a minimum of (3) client computers at each school location.~~
11. ~~Configure permissions on the recording servers to allow specific users to view live and recorded video.~~
12. ~~Entire video surveillance system tested and commissioned in the presence of the Owner's Representative.~~
13. ~~All Punchlist items identified during the testing and commissioning corrected to the satisfaction of the Owner's Representative.~~
14. ~~Operation and Maintenance manuals turned over to the Owner.~~
15. ~~Owner training 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 1080P 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).
 - 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 8-20 MEGA PIXEL 4-IMAGE SENSOR 4-CAMERA VANDAL RESISTANT DOME CAMERAS

A. Provide cameras meeting the following requirements:

1. Camera will consist of 4 individual ~~2MP~~ 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 ~~3MP~~ 5MP ~~1080P~~ 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 ~~P3727~~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.
- 2.3 HORIZONTAL PLENUM RATED CATEGORY 6 CABLE.
- A. See Section 271500 for requirements.
- 2.4 HORIZONTAL OSP RATED CATEGORY 6 CABLE.
- B. 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 ETHERNET / POE EXTENDERS FOR PARKING LOT LIGHT POLE MOUNTED CAMERAS

- A. Provide long range Ethernet Extender for light pole mounted cameras in the parking lot where shown on camera schedule.
- B. Extenders shall be wall mounted in the telecom room adjacent to wall mounted CAT 6 lightning protection entrance terminals. Input to the POE extenders shall be cross-connected to rack mounted 48-port CAT patch panels (see telecom drawings) via CAT 6 cable. Output of POE extenders shall be cross connected to wall mounted lightning protection entrance terminals via CAT 6 cable.
- C. Acceptable Products.
 - 1. Powered Ethernet Extenders:
 - a. Veracity Longspan VLS-1P-B transmitter, VLS-1P-C receiver and VPSU-57V-800 power supply.
 - b. Or Approved Equal.
 - 2. CAT 6 Entrance Protection Panels:
 - a. TII 606 Series Protection Panel with 65V Solid State Protector Modules P/N 606-65.
 - b. Or approved equal.

2.9 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.
- ~~A. Washoe County School District is currently standardized on the Milestone XProtect Corporate VMS software. The contractor shall integrate the cameras at each site with the existing software.~~
- ~~B. The contractor shall provide (1) Milestone XProtect Corporate "Device Channel License" for each camera as shown in the camera schedule. Each Device Channel License shall come with a Milestone 1 year "Care Plus" product maintenance agreement (PMA). During this 1 year period, Milestone will provide technical support and software upgrades at no cost to the School District.~~
- ~~C. See camera schedule for the required type and quantity of licenses.~~

- ~~D. Washoe County School District will provide and install a local "Recording Server" at each school. The contractor is responsible for providing, installing and configuring the Milestone XProtect Corporate "Recording Server" software on this server at each site.~~
- ~~E. Washoe County School District has an existing Milestone XProtect Corporate "Management Server" located at the East 9th Street Admin Office location. The contractor will be responsible for installing the "Device Channel Licenses" on this server and configuring the "Recording Server" at each site to communicate with this "Management Server".~~
- ~~F. At each project site (school) the contractor shall provide, install and configure "Client Viewing" software on (3) existing workstations as identified by WCSD. The contractor shall configure the client software to view cameras at the local school. Logical camera groups and screen layouts shall be configured on each computer.~~
- ~~A. Acceptable Products~~
 - ~~1. Milestone Systems XProtect Corporate Version 10.x Video Management System. Provide the following Software, Licenses and Product Maintenance Agreements (NOTE: Washoe County School Districts owns an XProtect Corporate "Base Server" license. The Contractor does not need to purchase an additional "Base Server" license for this project).~~
 - ~~a. Milestone Systems XProtect Corporate Version 10.x "Device Channel" License. Provide qty (1) license for cameras as shown in the Camera Schedule at each project site (Milestone P/N XPCODL).~~
 - ~~b. Milestone Systems XProtect Corporate Version 10.x "1 Year Care Plus" Produce Maintenance Agreement (PMA). Provide qty (1) 1-year PMA license for each camera shown in the Camera Schedule at each project site (Milestone P/N YXPCODL).~~
 - ~~c. No Substitutions accepted.~~

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.
 - a-d. Installation of Milestone Smart Client software on workstation computers at the project site.
-
- ~~2. Contractor shall procure cameras and provide a spreadsheet to WCSD 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.~~
 - ~~3. WCSD will procure the video recording server, install the server at the school and provide the contractor with logon credentials for the server.~~
 - ~~4. Contractor shall install, terminate and test cabling to the cameras. Contractor will provide certified cable test results to WCSD and provide patch cords for the cameras. WCSD will inspect the cabling installation and will issue a punchlist identifying any corrective action required. After the contractor has completed all punchlist items, WCSD IT will install the POE switches and patch cords to cross connect the cameras to the switches.~~
 - ~~5. Contractor shall connect, aim, focus and adjust the cameras. Each camera view must be reviewed and signed off by an Administrator or School Police Officer at the project site. WCSD's Project Manager will provide the contractor with the name of the person at each site responsible for signing off the camera views.~~
 - ~~6. Contractor shall install the Milestone Software on the recording server at the project site and shall configure communication between the recording server and the Milestone Management Server located at WCSD's East 9th Street administrative offices.~~
 - ~~7. Contractor shall assign new camera licenses to the Milestone Management Server as indicated in the camera schedule.~~
 - ~~8. Contractor shall configure all camera settings as required on the local site recording server including IP address, frame rate, compression, bit rate, motion detection, privacy masking, etc.~~
 - ~~9. Contractor shall configure storage locations for "live" recorded video and "archived" video on the server. Locate the recording server database on the local server hard drives (E: drive). Locate "archived" video on the~~

direct attached storage array (F: drive). Confirm storage locations with WCSD IT.

10. ~~Configure the recording server to overwrite "archived" video when the F: drive becomes greater than 80% full. Configure the software to overwrite the oldest video first.~~
11. ~~For each school site, the Contractor shall provide the names of the Principal, Vice Principal and Dean to the WCSD Project Manager. The Contractor shall assign view permissions to the cameras within the Milestone recording server software for the "STAFF" and "SCHOOL POLICE" groups. Only School Police, Principals, Vice Principals and Deans are allowed access via the Smart Client software. All other users must get permission from School Police.~~
12. ~~The Contractor shall configure logical site specific "camera viewing groups" within the Milestone Smart Client Software. The camera viewing groups shall be common to all users.~~
13. ~~WCSD IT will inspect the camera installation, software configuration and will issue a punchlist identifying any corrective action required. After the contractor has completed all punchlist items, the system will be re-inspected by WCSD IT.~~
14. ~~The Contractor shall install and configure the most current Milestone Smart Client software on three (3) computers at the project site as directed by the WCSD Project Manager.~~
15. ~~The Contractor shall provide 4 hours of training to the users at each project site. The training shall consist of (2) 2-hour training sessions as scheduled by WCSD.~~

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.
- I. ~~Logon to the camera and set the date and time. Set the time to Pacific Standard Time and configure the camera to automatically adjust to daylight savings time. Configure the camera to connect to a Network Time Protocol (NTP) server once every 24 hours and synchronize the time. Use WCSD's NTP server (IP Address 10.0.0.1 — verify with WCSD).~~
- J. ~~Add the camera to the database on the VMS "Recording Server" and load the appropriate drivers for the camera.~~
- K. ~~Configure camera ID, description and date/time stamping. The camera ID should follow the following naming convention: "School Name — Camera # — Area — Location". For example, Camera 3 at McQueen High would be named: "McQueen — 3 — 100 Wing — Main Entrance".~~
- L. ~~Change the default logon password on the IP camera web interface as directed by WCSD.~~

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.
- ~~P. Logon to the camera and set the date and time. Set the time to Pacific Standard Time and configure the camera to automatically adjust to daylight savings time. Configure the camera to connect to a Network Time Protocol (NTP) server once every 24 hours and synchronize the time. Use WCSD's NTP server (IP Address 10.0.0.1 – Verify with WCSD).~~
- ~~Q. Add the camera to the database on the VMS "Recording Server" and load the appropriate drivers for the camera.~~
- ~~R. Configure camera ID, description and date/time stamping. The camera ID should follow the following naming convention: "School Name - Camera # - Area - Location". For example, Camera 3 at McQueen High would be named: "McQueen - 3 - 100 Wing - Main Entrance".~~
- ~~S. Change the default logon password on the IP camera web interface as directed by WCSD.~~

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.
- ~~A. Configure the resolution on the cameras to the maximum setting 1920x1080 or 2048x1536 as applicable for each camera.~~
- ~~B. Aim the camera with the horizontal field of view shown on the drawings. Cameras set to a wider field of view than shown on the drawings or in a "fish-eye" configuration will be required to be re-adjusted by the contractor.~~

- C. ~~Adjust the vertical field of view so that the ceiling is not visible. For outdoor cameras, adjust the vertical field of view so that the sky is not visible. Secure the camera lens per the manufacturer's instructions.~~
- D. ~~Use the camera's web interface to focus the camera based on the field of view set above. Adjust the focus as necessary to provide a clear field of view.~~
- E. ~~Each school will have a dedicated onsite Representative responsible for reviewing and approving the aiming, field of view and focus of each camera. The contractor will be responsible for working with this dedicated representative and shall obtain the representative's sign-off for each camera. The contractor shall re-aim and/or re-focus the cameras as requested by Representative during testing/commissioning of the surveillance camera system.~~
- F. ~~After the aim and focus of each camera is approved by the onsite Representative, the contractor shall obtain a "screen shot" consisting of a full resolution JPG image of each camera view. The contractor shall submit color print outs on 8 1/2" x 11" of these images at the completion of the project.~~
- G. ~~Adjust the image quality settings on the camera to provide the clearest picture quality for all lighting conditions. The cameras have several settings that affect the image quality. The contractor shall consult with the camera manufacturer and shall adjust these settings to provide optimum image quality depending on the particular "scene" viewed by the camera.~~
- H. ~~Configure the cameras to automatically switch to daytime color and nighttime black & white mode as applicable for the lighting conditions.~~
- I. ~~For indoor cameras, configure the "motion" sensitivity settings within the video management software for each indoor camera so that images are only recorded when people or objects are moving within the field of view. Mask areas of the image that should not trigger motion based recording where applicable (i.e. ceilings, walls above 6' 0", trees, shrubs, etc). NOTE — THE PROPER CONFIGURATION OF THE MOTION SENSITIVITY SETTINGS IS CRITICAL TO THE PERFORMANCE OF THE SYSTEM. If the motion sensitivity is set too low, not all activity will be recorded by the system. If the motion sensitivity is set too high, images will be unnecessarily recorded resulting in server performance degradation and archiving issues.~~
- J. ~~Configure camera frame rate, compression and stream rate as follows:~~
 - 1. ~~Indoor Fixed Dome Cameras:~~
 - a. ~~Frame Rate — 15 fps.~~
 - b. ~~Compression — H.264.~~
 - c. ~~Bit Rate: 3mbps.~~
 - d. ~~Motion Detection: On — Record only when motion detected.~~
 - 2. ~~Outdoor Fixed Dome Cameras:~~

- a. ~~Frame Rate—15 fps.~~
- b. ~~Compression—H.264.~~
- c. ~~Bit Rate: 4mbps.~~
- d. ~~Motion Detection: Off—Record 24x7.~~

3. ~~Outdoor Fixed 4 Camera Sensor Cameras:~~

- a. ~~Frame Rate—10 fps.~~
- b. ~~Compression—H.264.~~
- c. ~~Bit Rate: 3-4mbps for each sensor (depending on size of view area).~~
- d. ~~Motion Detection: Off—Record 24x7.~~

3.8 ~~TESTING AND COMMISSIONING~~

A. ~~After completion of the project, the contractor shall test and commission the IP Video Surveillance System including all cameras and video management software in the presence of the Owner's Representative. The contractor shall notify the Owner's Representative a minimum of (1) week prior to testing.~~

B. ~~At a minimum, the following tests shall be performed.~~

- 1. ~~Verify physical mounting of all cameras.~~
- 2. ~~Verify network connectivity to all cameras.~~
- 3. ~~Verify aim and focus of all cameras.~~
- 4. ~~Verify that cameras have been properly focused for both daytime and nighttime use.~~
- 5. ~~Verify frame rate and image recording settings on all cameras.~~
- 6. ~~Verify privacy masking of camera views where applicable.~~
- 7. ~~Verify proper motion sensitivity adjustment of cameras.~~
- 8. ~~Verify archiving settings.~~
- 9. ~~Verify that device "channel" licenses have been installed on the "Management" server.~~
- 10. ~~Verify proper installation and configuration of the digital video recording software.~~
- 11. ~~Verify proper installation and configuration of the client software including permissions.~~

C. ~~After completion of the commissioning, the Owner's Representative shall prepare a Punchlist of all items to be corrected. After the contractor has completed the Punchlist items to the satisfaction of the Owner's Representative, the Project will be considered "substantially complete" at which time the warranty period will begin.~~

3.9 ~~TRAINING~~

A. ~~After completion of the camera installation, software installation, testing and commissioning, the contractor shall provide a minimum of 4 hours training to the Owner at each project location. Training shall cover usage and operation of the~~

~~cameras, video recording server software and client software. The training shall consist of two (2) 2-hour training sessions as scheduled by the Owner.~~

END OF SECTION

SECTION 328000 - IRRIGATION

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. Plant irrigation system
 - 2. Automatic controller
 - 3. Remote control valves
 - 4. Trenching
 - 5. Sleeves
 - 6. Backfilling

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Before any irrigation system materials are delivered to the job site, submit to the Owner a complete list of all irrigation system materials proposed to be furnished and installed. Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to method of installation.
- B. Provide at least one person who shall be present at all times during execution of this portion of the work, and who shall be thoroughly familiar with the type of materials being installed, and material manufacturer's recommended methods of installation, and who shall direct all work performed under this section. The Contractor shall have a minimum of 5 years experience in commercial or residential irrigation installation

1.6 CLOSEOUT SUBMITTALS

A. Record Drawings

1. Dimension from two permanent points of reference (buildings, monuments, sidewalks, curbs, pavement, etc.). Locations shown on as-built drawings shall be kept day to day as the project is being installed. All dimensions noted on drawings shall be neat and legible. Show locations and depths of the following items: Point of connection, Routing of sprinkler lines, Ball valves, Sprinkler control valves, Quick coupling valves, Routing of control and power wires, Sprinkler heads, Other related equipment.
2. Record drawings must be delivered to the Owner upon completion.

B. Operations and Maintenance Manual

1. Prepare and deliver to the Owner within ten calendar days prior to completion of construction, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in four individually bound copies of the operations and maintenance manual. The manual shall describe the material installed and shall be in sufficient detail to permit operating personnel to understand, operate and maintain all equipment. Spare parts lists and related manufacturer information shall be included for each equipment item installed. Each complete, bound manual shall include the following information:
 - a. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment with names and addresses of local manufacturer representatives.
 - b. Complete operating and maintenance instructions on all major equipment.
2. In addition to the above maintenance manuals, provide the maintenance personnel with instructions for system operation and show written evidence to the Owner at the conclusion of the project that this service has been rendered.
3. Final payment will not be made until record drawings and operation and maintenance manuals have been submitted and approved.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.
4. Store materials per manufacturer's specifications.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

1.10 WARRANTY

- A. Warranty requirements will be submitted to Owner upon substantial completion of work.
- B. The Contractor shall winterize the system and perform spring start-up of the system during the guarantee period. These functions shall be coordinated in advance with the Owner, and the Owner's personnel shall be encouraged to participate.
 1. Upon re-energizing the system, the Contractor shall repair any leaks or breaks and shall check each head and valve, making any adjustment necessary.
 2. Warranty Period: 12 months from date of irrigation completion.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) PIPE

- A. All mainlines and transmission lines shall be Schedule 40 PVC; laterals shall be schedule 40 PVC. Pipe shall be rigid unplasticized conforming to ASTM D-1784 and D-2241 standard specifications for PVC pipe. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, deleterious wrinkles, and dents.
- B. All pipe shall be continuously and permanently marked with the following information: Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73F (23C), color pantone #512, and National Sanitation Foundation (N.S.F.) approval.
- C. All above ground piping shall be epoxy painted purple (pantone color #512) and have a purple tag attached with the wording "warning recycled/reclaimed water do not drink" and "aviso agua impura no tomar" (t. christy enterprises, maxi valve identification tag, id-max-p2-rc006 or city of sparks approved equal).

2.2 MANUAL VALVES

- A. All manual ball valves, sizes three-inch (3") (75mm) and smaller, shall be full ported ball valves with maximum working pressure of 175 psi (1200kPa) and 350 psi (2400kPa) hydrostatic test pressure.
- B. All manual gate valves of four-inch (4") (100mm) size or larger shall be iron body, brass trimmed, double disc wedge type with integral taper seats and with non-rising stems, and shall be Mueller A-2360 resilient wedge gate valves with mechanical joints or equal accepted in advance by the owner. All manual gate valves shall be 200 psi (1380kPa) rated.

2.3 VALVE BOXES

- A. All remote control valves, manual control valves, zone shut-off valves, ball valves, or globe valves unless otherwise indicated, shall be installed in valve access box of proper size as required for easy access to the valve.
- B. Valve boxes shall not be located within a planting area. Valve boxes shall be placed with a minimum of five feet (5') (1.5m) separation between each valve box.
- C. All covers for meter boxes, valve boxes, flush valves, pressure reducing vaults, air/vac release assemblies, and all other appurtenances requiring vaults or boxes shall be purple in color (pantone color #512), labeled "reclaimed water" or "effluent", and have secured or locking lids. purple coloration shall be obtained from the manufacturer or be applied by powder coating or epoxy paint. all appurtenances shall have a purple tag attached with the wording "warning recycled/reclaimed water do not drink" and "aviso agua impura no tomar" (t. christy enterprises, maxi valve identification tag, id-max-p2-rc006 or city of sparks approved equal). a debris cap with purple coloration shall be installed inside of all round boxes.

2.4 EMITTERS

- A. All emitters of a particular type and for a particular function in the system shall be of the same manufacture and shall be marked with the manufacturer's name and identification, in such a position that they can be identified without being removed from the system.

2.5 IRRIGATION CONTROLLERS

- A. Field controllers shall be model numbers and manufacturers as shown on the plans or an acceptable equal.
- B. Field controllers shall be installed on approved concrete bases in accordance with the manufacturer's recommendations as shown on the drawings.
- C. Field controllers shall be installed with manufacturer's lightning and surge protection.
- D. Central controller shall be model number and manufacturers as shown on the plans, or acceptable equal. Central controller shall be located as shown on the drawings.

- E. On site lockable disconnects or lockable fuse block and a 110 volt outlet shall be installed at each controller in a separate lockable water-tight enclosure.
- F. All irrigation controller enclosures shall be labeled inside and outside warning that the system uses reclaimed water (t. christy enterprises, controller marking decal, part number #id-4100, or city of sparks approved equal).

2.6 REMOTE CONTROL VALVES

- A. All remote control valves shall be model numbers and manufacturers as shown on the plans or an acceptable equal. All splices shall be installed with 3M DBY and DBR types and all splices shall be made inside the valve box.

2.7 CONTROL WIRE

- A. All electric control and ground wire shall be irrigation control cable or approved equal, 14-gauge unless otherwise indicated on the drawings. All wiring to be used for connecting the automatic remote control valve to the automatic controllers shall be Type "UF", 600 volt, solid copper, single conductor wire with PVC insulation and bear UL approval for direct underground burial feeder cable.
- B. Insulation shall be 4/64-inch (1.6mm) thick minimum covering of ICC-100 compound for positive waterproofing protection. When more than one valve is operated by a single controller station, provide separate control wire from the controller to each valve, and one valve per box. Each valve should have no less than twenty-four inches (24") (600mm) of control cable inside valve box. Each wire shall be labeled at the valve box and at the controller to what zone each wire controls.
- C. Verification of wire types and installation procedures shall be checked to conform to local codes.

2.8 FITTINGS

- A. All plastic pipe fittings shall be permanently marked with the following information: Manufacturer's name or trademark, size, schedule and type of pipe, working pressure at 73F (23C), and National Sanitation Foundation (N.S.F.) approval.
- B. All plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld or screwed connections.
- C. Slip fitting socket taper shall be so sized that a dry unsoftened pipe end, conforming to these special provisions, can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be permitted. Only schedule 80 fittings may be threaded.

- D. When connection is plastic to metal, plastic male adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon Tape and Teflon paste. No oil-based products permitted.
- E. Solvent weld fittings shall be manufactured by Lasco, Spears, or acceptable equal. All lateral line fittings and mainline fittings two inches (2") (50mm) and smaller shall be schedule 40 solvent weld fittings.

2.9 SLEEVES

- A. Pipe sleeves shall be Schedule 40 PVC pipe, or equal.

2.10 CONCRETE

- A. All concrete shall be 3,000 psi (20,700kPa) at 28 days, transit mixed. Provide certifications with each delivery.

2.11 OTHER MATERIALS

- A. All other materials, not specifically described, but required for a complete and proper irrigation system installation, shall be new, first quality of their respective kinds, and included within the submittal to the Owner for approval.

PART 3 - EXECUTION

3.1 PRODUCT HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installed work and materials of all other trades.
- B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the owner and at no additional cost to the owner.

3.2 SURFACE CONDITIONS

- A. Inspection
 - 1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 - 2. Verify that trenching may be completed in accordance with the original design and the referenced standards.
 - 3. In the event of discrepancy, immediately notify the owner. Do not proceed with installation in areas of discrepancy until all discrepancies have been fully resolved.

3.3 TRENCHING

- A. Perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these Specifications.
- B. Make all trenches in accordance with OSHA Requirements with sufficient width to provide free working space at both sides of the trench and around the installed item as required for gluing, joining, backfilling, and compacting while minimizing width of trenches.
- C. All mainline shall have a minimum cover of thirty six inches (36") and a maximum cover of forty eight (48") above the pipe. All laterals shall be the same depth as the mainline. All lateral and main lines shall be installed in a straight line with no arching or bending of pipe. Change in direction of pipe shall occur only with the use of proper fittings only.
- D. Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the owner and then compact to provide a firm and unyielding subgrade to the approval of the owner and at no additional cost to the owner.
- E. Trench Bracing
 - 1. Properly support all trenches in strict accordance with all pertinent rules and regulations.
 - 2. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind will be fully protected from damage.
 - 3. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the owner and at no additional cost to the owner.
 - 4. Arrange all bracing, sheeting and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to provide sufficient strength.
 - 5. Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported.
- F. Grading and Stockpiling Trenched Material
 - 1. Control the stockpiling of trenched material in a manner to prevent water running into the excavations.
 - 2. Do not obstruct surface drainage but provide means whereby storm and waste waters are diverted into existing gutters, other surface drains, or temporary drains.
- G. All trench excavation shall be made by open cut. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading, and to prevent slides or cave-ins. The Contractor shall

remove all material not required for backfill or not suitable for backfill, from the site. Banks of trenches shall be kept as nearly vertical as possible, and shall be properly sheeted and braced as may be necessary to prevent caving.

- H. Trench widths in paved streets or in areas where proximity to other structures require vertical cuts, shall not be wider than is required for proper handling, jointing and bedding of the pipe.
- I. The bottom of the trenches shall be accurately graded to line and grade, and provide uniform bearing and support for each section of the pipe on undisturbed soil, at every point along its entire length. Depressions for joints shall be dug after the trench bottom has been graded, and shall be only of such length, depth and width as required for properly making the particular type joint. Care shall be taken not to excavate below the depths indicated.
- J. Where rock occurs in trench excavation, the rock shall be removed to a depth of six inches (6") (150mm) below the established grade line, and to a width of twelve inches (12") (300mm) greater than the outside diameter of the pipe to be installed in the trench.
- K. Where excavation of trenches requires the removal of asphalt pavement, the pavement shall be cut in a straight line along the edge of the excavation by use of a spade-bitted air hammer, concrete saw, or similar approved equipment to obtain straight, square and clean break; and, after backfilling and subgrade preparations are completed, hot plant mix asphalt concrete shall be replaced and compacted in accordance with the appropriate standard specification. Replaced base course and asphalt shall match removed sections.
- L. Excess material, including rock, broken concrete, bituminous materials, debris, or other materials not suitable for backfill, shall be removed from the site and disposed of by the Contractor.

3.4 SLEEVES

- A. Sleeves shall be installed wherever routing of a pipe, wiring, or both crosses a paved area or passes through a bored hole.
- B. Sleeves laid in open trenches shall be uniformly and evenly supported by undisturbed soil on the trench bottom. Backfill shall conform to standards hereinafter specified.

3.5 BACKFILL

- A. The trenching shall not be backfilled until inspection by the City has been completed and the pipe installation, including the grade, alignment, and jointing has been found to be in compliance with the requirements of the plans and specifications.

- B. Select backfill material consisting of sand, fine gravel or select earth, free of large lumps or rocks larger than one inch (1") (25mm) shall be used in backfilling around and over the installed pipe.
- C. The select material shall be obtained from the excavation material removed from the trench and shall be processed by screening, sifting, or selective sorting, so as to produce the type of backfill herein specified. The Contractor may at his option and own expense provide an acceptable imported material.
- D. This backfill material shall be carefully deposited around and over the pipe in layers not more than six inches (6") (150mm) thick, loose measurement, unless otherwise permitted by the City, wetted to optimum moisture content and uniformly compacted to at least 95 percent of the maximum density obtainable at optimum moisture content as determined by AASHTO T99 Method A or D (latest revision), until the pipe has a cover depth of at least twenty four inches (24").
- E. The remaining depth of the trench shall be backfilled with excavation material removed from the trench, which shall be wetted or dried to near optimum moisture content.

3.6 INSTALLATION OF PIPING

- A. Perform all trenching and backfilling as specified by the specifications in this Section.
- B. Lay out the piping system in strict accordance with the plans. Where piping is shown on the plans to be under paved areas, but running parallel and adjacent to planted areas, the intention is to install the piping in the planted areas.
- C. All mainlines and laterals shall be installed with thirty six inches (36") minimum cover, and a maximum of forty eight inches (48") cover, over the pipe.
- D. All lines shall have a minimum clearance (horizontal and vertical) of four inches (4") (100mm) of adjacent pipe from each other, and six inches (6") (150mm) from lines of other trades, except through pipe sleeves. Parallel lines shall not be installed directly over one another.
- E. Carefully inspect all pipe and fittings before installation, removing all dirt, scale, and burrs and reaming as required; install all pipe with all markings up for visual inspection and verification.
- F. PVC Pipe
 - 1. Plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the manufacturer.
 - 2. All plastic joints shall be solvent-weld joints. Only the solvent cement recommended by the pipe manufacturer shall be used. All plastic pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer and it shall

be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. The Contractor shall assume full responsibility for the correct installation.

3. All plastic to metal joints shall be made with plastic adapters.
4. The solvent-weld joints shall be made dry.
5. The solvent-weld joints shall be allowed to set at least 24 hours before pressure is applied to the system on PVC pipe.
6. Swing joints shall be installed on the same side of the pipe as the head. Swing joints may not cross pipe laterally.

3.7 INSTALLATION OF EQUIPMENT

- A. All fittings, valves, etc. shall be carefully placed in the trenches as shown on the plans.
- B. All control wires shall be clearly labeled, by station, using weatherproof material, both at the controller and at the valve. The outside cover of all automatic valve boxes shall also have the station number clearly stamped on the cover.

3.8 TESTING AND INSPECTION

- A. Closing-in Work
 1. Do not allow or cause any of the work in this section to be covered up or enclosed until it has been inspected, tested, and approved by the owner.
 2. Where trenches are not closed at the end of the day Contractor shall accept all liability for any damage or injury that may result from open trenches. Provide barricades and warning tape as necessary around all open trenches.
- B. Before backfilling the mainline, and with all control valves in place, completely flush and test the mainline and repair all leaks; flush out each section of lateral pipe before sprinkler heads are attached.
- C. Testing
 1. Make all necessary provisions for thoroughly bleeding the line of air and debris.
 2. Before testing, fill the line with water for a period of at least 24 hours.
 3. After valves have been installed, test all installed irrigation lines for leaks at a pressure of 150 psi (1035 kPa) for a period of two hours, with all couplings exposed and with all pipe sections center loaded.
 4. Furnish all necessary testing equipment and personnel.
 5. Correct all leaks and retest until acceptance by the Engineer.
- D. Final Inspection
 1. Thoroughly clean, adjust, and balance all systems.

- E. Demonstrate the entire system to the Engineer, proving that all remote control valves are properly balanced, that all heads are properly adjusted for radius and arc of coverage, and that the installed system is workable, clean, and efficient.

END OF SECTION 328000

SECTION 329113 - SOIL PREPARATION

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 planting soils.

1.3 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."
- K. Planting Soil: Imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. 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.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.7 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 - 1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

- a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
 2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
 2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
 3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
 4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.
- D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT WERA-103, including the following:
1. Percentage of organic matter.
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).
 4. Buffered acidity or alkalinity.
 5. Nitrogen ppm.
 6. Phosphorous ppm.
 7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.
 12. Copper ppm.
 13. Sodium ppm[and sodium absorption ratio].
 14. Soluble-salts ppm.
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.

- E. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
 - 1. Fertilizers and Soil Amendment Rates: State recommendations in weight per cu yd of soil.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Do not move or handle materials when they are wet or frozen.
 - 4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOILS

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
- B. Planting-Soil: Manufactured soil consisting of manufacturer's basic topsoil, blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials to produce viable planting soil.
 - 1. Additional Properties of Manufacturer's Basic Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 5 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
 - 2. Unacceptable Properties: Manufactured soil shall not contain the following:
 - a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
 - b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil.
 - c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches (50 mm) in any dimension.

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 a No. 8 (2.36-mm) sieve and a minimum of 75 percent passing through a No. 60 (0.25-mm) sieve.
 - 2. Class: O, with a minimum of 95 percent passing through a No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through a No. 60 (0.25-mm) sieve.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through a No. 40 (0.425-mm) sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 (0.30-mm) sieve.
- F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance".
- B. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
- C. 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. 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: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 329113

SECTION 329300 - PLANTS

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. Plants.
 - 2. Tree stabilization.
 - 3. Landscape edgings.

1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.
- C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less diameter and depth recommended by ANSI Z60.1 for type and size of plant required.
- D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.
- E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.
- F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.
- G. Finish Grade: Elevation of finished surface of planting soil.

- H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- J. Planting Area: Areas to be planted.
- K. Planting Soil: Imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- M. 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.
- N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
- B. Samples for Verification: For each of the following:
 - 1. Mineral Mulch: 2 lb (1.0 kg) of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
 - 2. Weed Control Barrier: 12 by 12 inches (300 by 300 mm).
 - 3. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
- B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
 - 1. Manufacturer's certified analysis of standard products.
 - 2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
- C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
 - 1. Experience: Three > years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
 - 1. Selection of plants purchased under allowances is made by Architect, who tags plants at their place of growth before they are prepared for transplanting.
- C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
 - 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
- D. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.
- B. Bulk Materials:
 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Accompany each delivery of bulk materials with appropriate certificates.
- C. 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.
- D. Handle planting stock by root ball.
- E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.
- F. 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. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 2. Do not remove container-grown stock from containers before time of planting.
 3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.10 FIELD CONDITIONS

- A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- B. Planting Restrictions: Plant during one of the following periods..
 1. Spring Planting: April 1 – June 15.
 2. Fall Planting: September 1 – November 15.

- C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.11 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.
 - b. Structural failures including plantings falling or blowing over.
 - 2. Warranty Periods: From date of planting completion.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, and Other Plants: Three months.
 - 3. Include the following remedial actions as a minimum:
 - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
 - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated 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.
 - 1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots are unacceptable.
 - 2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.
- B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.
- E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 FERTILIZERS

- A. 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.

2.3 MULCHES

- A. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:
 - 1. Type: [Rounded riverbed gravel or smooth-faced stone] [Crushed stone or gravel] [Marble chips] [Granite chips] <Insert stone type>.
 - 2. Size Range: As indicated on plans.
 - 3. Color: Readily available natural gravel color range acceptable to Architect.

2.4 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. (101g/sq. m) minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally encountered chemicals, alkalis, and acids.

2.5 PESTICIDES

- A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
- C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.6 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal (38-by-38-mm actual) by length indicated, pointed at one end.
2. Guy Cables: Five-strand, 3/16-inch- (4.8-mm-) diameter, galvanized-steel cable, with zinc-coated turnbuckles a minimum of 3 inches (75 mm) long, with two 3/8-inch (10-mm) galvanized eyebolts.
3. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

2.7 LANDSCAPE EDGINGS

a.

B. Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B 221 (ASTM B 221M), Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.

1. Edging Size: [3/16 inch (4.8 mm) thick by 5-1/2 inches (140 mm) deep.
2. Stakes: Aluminum, ASTM B 221 (ASTM B 221M), Alloy 6061-T6, approximately 1-1/2 inches (38 mm) wide by 12 inches (300 mm) long.
3. Finish: Manufacturer's standard finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
 3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 4. Uniformly moisten excessively dry soil that is not workable or which is dusty.
- B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

- A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."
- B. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits.
 - 1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. 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.
 - 2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
 - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
 - 4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
 - 5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
 - 6. Maintain supervision of excavations during working hours.
 - 7. Keep excavations covered or otherwise protected [overnight] [after working hours] [when unattended by Installer's personnel].
- B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless otherwise indicated.
- C. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.
- D. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

- A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.
- B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
 1. Backfill: Planting soil.
 2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 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 equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Two per plant.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch (25 mm) above adjacent finish grades.
 1. Backfill: Planting soil.
 2. 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 equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
 - a. Quantity: Two per plant.
 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. Slopes: 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.

3.6 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 as directed by Architect.
- C. 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.
- D. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

- A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
 - 1. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1830 mm) above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
 - 2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
 - 3. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough 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.

3.9 PLANTING AREA MULCHING

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches (150 mm) and secure seams with galvanized pins.

- B. Mulch backfilled surfaces of planting areas and other areas indicated.
 - 1. Mineral Mulch in Planting Areas: Apply 3-inch (75-mm) average thickness of mineral mulch extending 12 inches (300 mm) beyond edge of individual planting pit or trench and over whole surface of planting area], and finish level with adjacent finish grades. Do not place mulch within 3 inches (75 mm).

3.10 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.
- 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 integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.11 REPAIR AND REPLACEMENT

- A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Species of Replacement Trees: Species selected by Architect.

3.12 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.
- C. 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.

- D. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

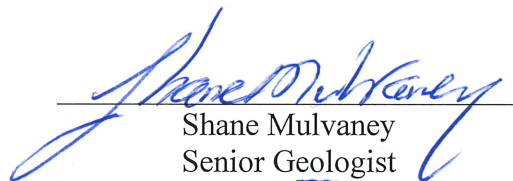
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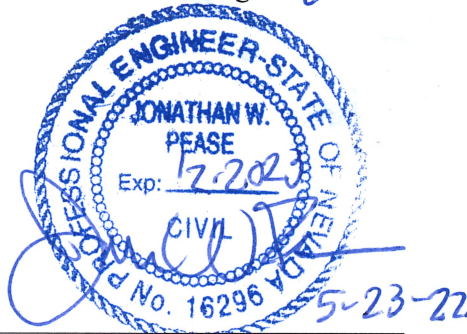
**GEOTECHNICAL INVESTIGATION REPORT
WASHOE COUNTY SCHOOL DISTRICT
TRANSPORTATION FACILITY
1850 KLEPPE LANE
SPARKS, NEVADA**

A Report Prepared For:

Washoe County School District
Board of Trustees
425 East 9th Street
P.O. Box 30425
Reno, Nevada 89512
Email: BoardMembers@WashoeSchools.net

Prepared By:


Shane Mulvaney
Senior Geologist



Jonathan W. Pease, PhD. P.E. G.E.
Civil Engineer (NV) 16296

 **Reno Tahoe Geo Associates, Inc.**

P.O. Box 18449
Reno, Nevada 89511
(775) 853-9100

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Appendix A – Liquefaction Analysis Results

1.0 INTRODUCTION AND SCOPE

1.1 Project Description

This report presents the results of Reno Tahoe Geo Associates' (RTGA's) geotechnical investigation for design and construction of new facilities at the existing Washoe County School District Transportation Facility located at 1850 Kleppe Lane in Sparks, Nevada (Plate 1). These facilities will include a new building including a bus maintenance garage and offices, a bus wash facility, and modified vehicle circulation and layout of the parking lots. The main building will generally be one-story with portions that have a second story or mezzanine. A site map showing the proposed layout of the new building, wash bay, and parking areas are presented as Plate 2.

Structural loads were not available and were assumed for the purposes of this proposal. Estimated vertical structural loads are not expected to exceed 40 kips at isolated columns and 2 kips to 4 kips per linear foot along continuous wall foundations for long-term loading conditions. Building pad construction is anticipated to consist of cuts and fills of about two feet or less. New pavements will be required for areas that were not previously paved or where buildings will be removed.

1.2 Purpose and Scope of Work

The purpose of this investigation was to explore and evaluate the subsurface conditions at the project site, and to provide our geotechnical engineering recommendations for project design and construction. The scope of our services outlined in our proposal dated March 7, 2022, included the following:

- General geologic setting and seismicity;
- General soil and groundwater conditions at the project site, with emphasis on how the conditions are expected to affect the proposed construction;
- Recommendations for earthwork construction, including site preparation recommendations, a discussion of reuse of existing near surface soils as engineered or non-structural fill, and a discussion of remedial earthwork recommendations, if warranted;
- Recommendations for temporary excavations and trench backfill;
- Recommendations for conventional shallow spread foundation design including soil bearing values, minimum footing depth, resistance to lateral loads and estimated settlements;

- International Building Code Soil Class for use in structural design;
- Lateral earth pressures and drainage recommendations for short retaining structures;
- Subgrade preparation for slab-on-grade concrete and modulus of subgrade reaction based on site soil classifications;
- Site liquefaction potential;
- Pavement structural sections for parking lots; and
- Potential for site soils to corrode steel, or to adversely react with concrete.

This investigation excludes a site-specific evaluation of seismicity, site-specific response spectra, faulting, or other geologic hazards.

1.3 References

The following information was provided to Reno Tahoe Geo Associates, Inc. (RTGA) over the course of this investigation and served as the basis of our understanding of the project type and scope:

- Collaborative Design Studio, WCCSD Central Transportation Yard, Conceptual Drawings, April 18 and May 12, 2022.

In addition, the following published and unpublished references were reviewed during preparation of this report:

- ASCE, 2022, ASCE 7 Hazard Tool, accessed April 2022.
- Abbott, Robert E. and Louie, John N., 2000, Depth to bedrock using gravimetry in the Reno, and Carson City, Nevada, area basins: Geophysics, v. 65, no. 2 (March-April); p. 340–350, 13 FIGS., 2 TABLES.
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- Idriss, I. M. and Boulanger, Ross W., (2008), "Soil Liquefaction During Earthquakes" EERI, Berkeley, California.
- Nevada Bureau of Mines and Geology (NBMG), 1998, *Guidelines for Evaluating Potential Surface Fault Rupture/Land Subsidence Hazards in Nevada (Revision 1)*,

http://www.nbmng.unr.edu/nesc/NESC_Seismic_Building_Guidelines/Guidelines_Surface_Fault_Rupture.pdf.

- Nelson, John D. and Miller, Debora J., 1992, “Expansive Soils: problems and practice in foundation and pavement engineering,” John J. Wiley & Sons Inc.
- Ramelli, Alan R., Henry, Christopher D., and Walker, Jerome P., 2011, Preliminary Revised Geologic Maps of the Reno Urban Area, Nevada Bureau of Mines and Geology, Scale 1:24,000.
- Seed, R. B., Cetin, K. O., Moss, R.E., Kammerer, A.M., Wu, J., Pestana, J. M., Reimer, M. F., Sancio, R. B., Bray, J. D., Kayen, R. E., and Faris, A., 2003, “Recent Advances in Soil Liquefaction Engineering: A Unified and Consistent Framework.” University of California, Earthquake Engineering Research Center Report 2003-06, 72 p.
- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Web Soil Survey (WSS), Washoe County, Nevada, accessed April 2022.
- U.S. Geological Survey, 2020, Quaternary Fault and Fold Database of The United States, accessed March 2020.
- Youd, T. L. Chair, Member, ASCE, I.M. Idriss, Co-Chair, Fellow, ASCE, Ronald D. Andrus, Ignacio Arango, Gonzalo Castro, John T. Christian, Richardo Dobry, W. D. Liam Finn, Leslie F. Harder, Jr., Mary Ellen Hynes, Kenji Ishihara, Joseph P. Koester, Sam S. C. Liao, William F. Marcuson III, Geoffrey R. Martin, James K. Mitchell, Yoshiharu Moriwaki, Maurice S. Power, Peter K. Robertson, Raymond B. Seed, and Kenneth H. Stokoe II, 2001, *Liquefaction Resistance of Soils: Summary Report*, from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, *Journal of Geotechnical and Geoenvironmental Engineering*, October, 2001, p. 817-833.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Exploration consisted of eight soil borings and one shear wave velocity survey. Our selection of field exploration locations was based on client recommendations, the anticipated project layout, and site access. Exploration locations are shown on Plate 2.

2.2 Borings

Eight soil borings were advanced on April 18 and 22, 2022. Borings were drilled with a track-mounted CME 550 soils sampling drill rig using 4-inch-outside-diameter (O.D.), continuous-flight augers. Boreholes were drilled and sampled to depths of between 6.5 feet to 31.5 feet. Borehole logs are presented on Plates 3 through 10.

The native soils were sampled in-place every 2-1/2 to 5 feet depth by use of a 1.5-inch-inner-diameter (I.D.), 2-inch outer diameter (O.D) Standard split-spoon drive sampler or a 2.6-inch-I.D., 3-inch-O.D. Modified California drive sampler. At appropriate depths, 3-inch diameter Shelby tubes were employed to collect relatively undisturbed samples in cohesive soils.

The drive samplers were driven by a 140-pound automatic drive hammer with a 30-inch stroke. The number of blows to drive the sampler the final 12 inches of an 18-inch penetration (Standard Penetration Test [SPT]- ASTM D 1586) into undisturbed soil is an indication of the density and consistency of the material. Penetration resistance using the Modified California sampler is higher due to the larger diameter and greater ground resistance. Modified California sampler blow counts should be multiplied by 0.65 to obtain an equivalent SPT blow count.

Ground water levels were measured when encountered.

Our engineer or geologist visually classified and logged the soil conditions encountered according to the Unified Soil Classification System and obtained bulk samples of representative soil stratum for further identification and laboratory testing. Soil samples were packaged and sealed in the field to reduce moisture loss and disturbance and returned to our laboratory for testing. The Unified Soil Classification System (USCS) description and a key to log symbols are presented on Plate 11.

Due to the relatively small diameter of the samplers, the maximum particle size that could be obtained was approximately 3 inches. The final logs may not, therefore, adequately represent the actual quantity or presence of cobbles or boulders.

2.3 ReMi Shear Wave Velocity Measurements

One ReMi (Refraction Micrometer) survey was utilized to obtain shear wave velocity measurements near the proposed new building footprint (see Plate 2). ReMi provides a means to obtain basic subsurface profile information on an essentially continuous basis across the explored location. The ReMi survey consists of placing twelve geophones placed in a line at 33 feet spacing, which then record background vibration including natural microtremors, nearby traffic, and other sources. These data are processed to determine the slowest arrival time of seismic waves to interpret a shear-wave-velocity profile with depth. The ReMi shear wave velocity array was utilized to obtain one- and two-dimensional shear wave velocity profiles which are illustrated on Plate 12.

2.4 Laboratory Testing

Laboratory tests were performed on selected samples to aid in soil classification and to evaluate physical properties of the soils, which may affect the geotechnical aspects of project design and construction. We performed laboratory testing on selected soil samples to assess the following:

- Soil Classification (ASTM C136, C117, D422 and D1140)
- Resistance Value (R-Value) for pavement design

In addition, the following analytical tests were performed:

- Soluble Sulfate, Resistivity, and pH

Laboratory test results are summarized on the boring logs (Plates 2 through 9), and detailed testing results are provided on Plates 13 through 17.

3.0 PROJECT CONDITIONS

3.1 Site Conditions

The rectangular site is bounded by Kleppe Lane to the south, the Union Pacific Railroad right-of-way to the north, and adjacent industrial properties to the east and west. The western two-thirds of the site hosts a paved school bus and employee parking lot, an employee administrative building, and bus fueling facility. The eastern one-third of the property hosts four buildings formerly associated with the Nevada Civil Air Patrol which are now part of the bus maintenance facility. The rest of the eastern parcel is largely unpaved gravel parking. The north and west edges of the site were formerly the alignment of a regional drainage channel, the North Truckee Drain, which provide stormwater and irrigation runoff outlet from former ranch areas of Sparks to the Truckee River. The North Truckee Drain was about 20 feet wide at water level and about 12 to 15 feet depressed below adjacent grade. The drain ditch flowed from west to east across the north edge of the site, angled slightly southeast 50 to 200 feet onto the eastern corner of the property, and then flowed south along the east property line. In 2017 and 2018, the drain ditch was backfilled, and the flow was replaced by a large (10-foot deep, 40-foot wide) box culvert in the northern portion of the project parcel. The box culvert traverses from west to east and continues nearly due east to a new outfall into the Truckee River at the end of Larkin Circle. The box culvert underlies the current gravel parking lots. A smaller drainage structure follows the former North Truckee Drain alignment for local stormwater control.

Site elevations range from approximately 4,390 feet at Kleppe Lane to 4,392 feet on most of the property. The site lies on variable thickness of fill placed in the former low channels of the Truckee River and there little or no slope on this or the adjacent parcels. A rectangular portion of the eastern third of the property under the existing building (and where the new major facilities are planned) is filled about 4 to 5 feet higher than the other portions of the site to Elevation 4,395 to 4,396 feet.

3.2 Geologic Conditions

The site is located in the northeastern Truckee Meadows, which is located within the western edge of the Basin and Range Geological province. The Basin and Range geologic province is categorized by generally north-south trending ranges and valleys that are formed by east-west extension of the terrane by normal faulting that has been occurring since Tertiary time. The eastern Sparks area is a tectonic basin developed by downfaulting and concurrent sedimentary infill of the Truckee Meadows (the valley including Sparks and the project site). The Tertiary bedrock surface under the site has

been estimated by Abbott and Louie (2000) to be at roughly 2,000 feet depth at this location by using gravimetric and seismic refraction studies. Both sides of the alluvial valley are flanked by normal (dip-slip) faults which depress the bedrock below the valley surface at the site and raised the bedrock on either side into the Carson and Virginia Ranges. The Truckee Meadows is flanked on the east the Virginia Range which is generally comprised of by Tertiary-age andesite, basalt, and related rock types. On the west the Truckee Meadows is bordered by the Carson Range, which is partially composed of granitic or granodioritic bedrock, which typically erodes to granular alluvial materials.

The geologic map (NBMG, 2011) indicates that the site is located on Holocene floodplain deposits consisting of clay, silt, and minor sand lenses. The site was in the former active floodplain of the Truckee River before it was filled for industrial development. The north side of Kleppe Lane (encompassing the project site) was a wide flood channel with a narrow meandering low-flow channel that was above the main Truckee River and likely was a high-flow channel during strong flooding events on the Truckee River. The floodplain deposit is occurring at the downstream outlet of the Truckee Meadows due to low-gradient, fine-grained overbank flood deposition in the past and historically. This unit typically overlies a coarser unit of sand, gravel, cobbles, and locally boulders which is referred to as the Tahoe Outwash. This deeper deposit was laid down by massive glacial floods emanating from the Sierra Nevada during the Tahoe Glaciation approximately 15,000 to 30,000 years before present.

The USDA National Resource Conservation Survey (NRCS) Web Soil Survey maps the site as two primary map units.

- *Fettic silty clay loam* comprises approximately 95 percent of the site. This unit is described as mixed alluvium on stream terraces containing silt clay loam, clay loam, and stratified loamy sand to silty clay. It is somewhat poorly drained with very high runoff class and very low to moderately low capacity to transmit water (K_{sat} 0.00 to 0.06 in/hr).
- *Xeric Torriothents-Urban land complex* comprises approximately 5 percent as a narrow strip along the northern property boundary. This unit is mixed alluvium formed on fan piedmonts with variable content. It is well drained with very low runoff class and moderately low to very high capacity to transmit water (K_{sat} 0.06 to 19.98 in/hr).

3.3 Results of Site Explorations

Results of our geotechnical exploration are consistent with the geologic map description. Borehole drilling at the site indicated engineered fill in the areas of boreholes B-2, B-3, B-5, and B-6 generally consists of:

- Very stiff silty to clayey sand, some of which is fill, 7 to 8.5 feet thick near Kleppe Lane. Borehole B-2 logged as 7 feet of silty gravel and clayey sand fill.
- With the exception of the B-2 area, native near surface deposits are composed primarily of stiff lean clayey sand (with around 40 to 50 percent fines) with thinly to moderately interbedded medium dense silty sand layers to approximately 21 feet depth.
- At about 21 feet depth in borings B-2, B-3, and B-5, there is an intermittent loose clayey gravelly sand layer that varies between 3 and 7 feet thick that is loose to medium dense. This layer represents a low-energy transition between the underlying high-energy coarse flood deposits and the overlying clays which were deposited in a low-energy alignment.
- Very-dense, highly competent, well graded, sand to gravelly sand was encountered at the bottom of the boreholes starting at 24 to 27 feet below existing grade. This layer represents the Tahoe Outwash soils and typically extends to greater than 100 feet depth in the project vicinity.

Groundwater was encountered beneath the native medium plasticity clay at depths of 21 to 22 feet during drilling.

Results of ReMi analysis indicate generally low-shear-wave velocity material to a depth between 4 to 8 feet along the length of the line which is likely clayey sand fill. Soils are medium dense or stiff between 4 to 8 and 25 to 35 feet depth, which is assumed to represent the stiff clays and medium-dense gravelly sands. This layer increases in depth to the north. Below about 25 to 35 feet depth, soils are very dense which is representative of the Tahoe Outwash sands and gravels of Pleistocene age. The average shear wave velocity measured in the upper 100 feet of the soil/bedrock horizon was 1,203 feet per second. The ReMi survey results are shown on Plate 12.

3.4 Geologic Hazards

3.4.1 Seismicity

The project site lies within an area with a high potential for strong earthquake shaking. Seismicity within the Truckee Meadows area is considered above-average for the western Basin and Range Province. The maximum possible earthquake in this area that could occur would be in the range of magnitude 7.0 to 7.4 along the Mount Rose Fault Zone which trends generally north-south along the western edge of the valley.

3.4.2 Fault Rupture

The east edge of the Truckee Meadows is defined by unnamed fault splays of undifferentiated Quaternary age with no reported recent movement. These have been mapped by NBMG (2011) as no closer than 1,500 feet east of the site. Ramelli et al identifies a potential concealed fault on the east side of Sparks Boulevard about 800 feet west of the site. Splays of the Mount Rose Fault Zone have been mapped to within 3 miles west of the site, trending southwest to northeast. This latest-Quaternary, well-constrained Class A fault displays normal movement of 1 to 5 millimeters per year with an unspecified dip direction.

The Nevada Earthquake Safety Council (NESC, 1998) has developed and adopted the criteria for evaluation of Quaternary age earthquake faults. *Holocene Active Faults* are defined as those with evidence of movement within the past 10,000 years (Holocene time). Those faults with evidence of displacement during the last 130,000 years are termed *Late Quaternary Active Faults*. A *Quaternary Active Fault* is one that has moved within the last 1.6 million years. An *Inactive Fault* is a fault *without recognized activity within Quaternary time* (last 1.6 million years). Holocene Active Faults normally require that occupied structures be set back a minimum of 50 feet (100-foot-wide zone) from the ground surface fault trace. No faulting has been mapped passing through the project site, therefore no building or other structural setbacks are required.

3.4.3 Liquefaction

Liquefaction is a nearly complete loss of soil shear strength that can occur during a seismic event in saturated, loose to medium dense, poorly-graded sands, silty sands, cohesionless silts, and sometimes gravels. Liquefaction results from cyclic shear stresses and strains causing partial collapse of the soil matrix and development of excess pore water pressure between the soil grains. The primary factors affecting liquefaction potential of a soil deposit are: (1) amplitude and duration of seismic ground motions; (2) soil type and density; and (3) depth to groundwater or saturation. The potential consequences of liquefaction to engineered structures include: post-liquefaction settlement, sand boils, increased lateral earth pressures on retaining walls that retain liquefied soil, lateral spread, loss of bearing capacity, and other slope instability.

Liquefaction only occurs in loose to medium dense, generally granular soils, below the groundwater table. Liquefaction will result in settlements shortly after the earthquake due to the reconsolidation of the liquefied soil structure. Water and sand may be expelled to the surface, referred to as sand boils; these may cause minimal damage, except if building footings are located directly over a major sand boil. For sites with gentle slopes or with an adjacent slope, significant damage may potentially result from ground oscillation or lateral spreading. These horizontal deformations occur due to either the earthquake motions imparted to the surface soils, or the driving force of the existing ground surface slope, which causes the surface soils to move with relatively little resistance from the underlying liquefied soils. Lateral spread can occur due to liquefaction under gently sloping ground with slopes shallower than 1 percent. Lateral spread involves permanent ground displacement that accumulates in the down-slope direction due to shearing of the liquefied material during or shortly after earthquake shaking. Lateral spread displacements have historically been a significant proportion of building damage reported after earthquakes.

3.5.1 Liquefaction Potential Triggering Methodology

Liquefaction potential was analyzed and compared using the site SPT data and three methods, Youd et al. (2001) Idriss and Boulanger (2008), and Seed et al (2003). A design peak ground acceleration (PGA) of 0.70g and a design earthquake magnitude of M=7.0 were used.

The three liquefaction evaluation methods analyze the effects of fines and the plasticity of soils differently. All three include an upward correction of blowcount with increasing fines content up to

35 percent fines to obtain an estimate of “equivalent clean sand penetration resistance.” Youd et al. (2001) recommends that soils above 35 percent fines content are either non-liquefiable, or, if they are liquefiable, evaluation from penetration resistance may not be appropriate. Soils above 35 percent fines content may be determined as liquefiable if they meet all the following criteria:

- Liquid limit less than 35 (Youd et al 2001) or 37 (Idriss and Boulanger, 2008, Seed et al, 2003);
- Plasticity Index less than 7 (Youd et al, 2001; Idriss and Boulanger, 2008) or 12 (Seed et al, 2003); and
- Water content/Liquid Limit ratio of greater than 0.85 (Youd et al, 2001) or 0.80 (Idriss and Boulanger, 2008; and Seed et al, 2003).

All three SPT-based methods used in our analysis indicate the presence of limited zones of clayey sands meeting the criteria for liquefiable soils. The upper clayey sand layers were eliminated by using the above criteria. Post-liquefaction consolidation settlements were computed using the method of Tokimatsu and Seed (1987).

3.5.2 Predicted Liquefaction Potential

The liquefaction triggering analyses for each of the deeper borings that encountered the sand layers are provided in Appendix A. A summary of the results is provided in Table 1 stated in terms of liquefied thickness and potential ground deformation effects for the selected design earthquake event. The potential for liquefaction effects is generally proportional to the cumulative thickness of liquefied deposits.

TABLE 1 – SUMMARY OF PREDICTED LIQUEFACTION			
Location	Cumulative Liquefiable Thickness (feet)	Depth Interval (feet)	Estimated Post-Liquefaction Settlement (inches)
B-2	8	21 - 29	1.5 - 2
B-3	0	--	0
B-5	2.5	22 -24.5	0.5

We conclude that minor liquefaction potential is present that could cause on 0 to 2 inches of total settlement during the design earthquake, with an average of 0.8 inches settlement. Assuming columns and major supports located at 40 to 50 feet on center, maximum differential settlement per bay would be on the order of $\frac{3}{4}$ -inch. With the exception of the raised fill under the southeast corner of the site, the region is very flat and is not expected in significant permanent lateral deformation. Transient and or permanent lateral deformation would most likely be less than one foot.

4.0 DISCUSSION AND CONCLUSIONS

From a geotechnical engineering standpoint, the proposed structures may be developed as planned. Based on the results of our field investigation and laboratory testing programs, we have developed the following conclusions. These conclusions may change if additional information becomes available.

- Engineered fill in the areas of boreholes B-2, B-3, B-5, and B-6 generally consists of silty to clayey sand which is 2 to 8.5 feet thick. Natural deposits are stiff clayey sand to lean clay starting below 2 to greater than 6.5 feet which are similar but generally higher moisture content and settlement potential. Both units have plasticity which can result in poor compaction characteristics and low to moderate expansive potential.
- Groundwater was encountered beneath native lean clay at depths of 21 feet to 22 feet. Groundwater is not expected to interfere with the proposed foundation excavation.
- It is anticipated that site grading can be performed with conventional earthmoving equipment. In general, existing fill soils are marginally suitable for re-use as structural fill. Foundations and slabs will require separation from clayey soils by at least 2 feet of compacted structural fill.
- Results of corrosivity testing of site soils indicates a severe degree of corrosivity due to low resistivity and soluble sulfate content. Type V Portland cement should be used where cement will come into contact with native site soils. Special corrosion mitigation measures such as cathodic protection should be implemented for buried steel pipes.

Specific recommendations for project design and construction including mitigation of potential problems described above are presented in Section 5.0.

5.0 RECOMMENDATIONS

5.1 Site Clearing and Preparation

Prior to construction all man-made debris should be removed from the site. RTGA representative should be present during stripping and site preparation operations to observe stripping and grubbing depths. Excavations resulting from removal operations should be cleaned of all loose materials and widened as necessary to permit access by compaction equipment.

Dust control will be the responsibility of the contractor. A dust control plan should be prepared by the owner, civil engineer, or contractor prior to the start of grading.

Following site stripping and any required grubbing, we recommend all areas to receive structural fill or to be used for the future support of pavements be scarified to a depth of at least 8 inches, uniformly moisture-conditioned to near optimum moisture content, and compacted to at least 90 percent relative compaction*.

5.2 Liquefaction Mitigation Alternatives

As outlined in this report, potential liquefaction settlements of 0.5 to 2 inches are predicted during the design earthquake at this site. Potential mitigation methods include: structural mitigation with a mat foundation, driven pile foundations, or ground improvement using compaction grouting. Additional investigation may also be appropriate to assess the hazards or conditions by cone penetration tests or borings between the existing exploration points to further define the extent of each issue.

5.2.1 Structural Mitigation

A tied shallow foundation may be suitable for the building to mitigate liquefaction risk. The 2018 International Building Code provides recommendations for foundations on liquefiable sites in Section 12.13.9. The building is assumed to be Risk Category II, and because lateral spread is predicted to be less than 12 inches, the site will meet the requirements of Table 12.13-2. As total settlement due to liquefaction is expected to not exceed 1 inch and typical column spacing might be 25 to 33 feet, the differential settlement is not expected to exceed 0.010L on Table 12.13-3. For this condition, a

*Wherever referenced in this report, relative compaction should be determined by comparing the in-situ densities of the site soils to the maximum dry density and optimum moisture content as established in accordance with the ASTM D1557 Test Method.

tied shallow foundation would be acceptable. Tie beams between foundations and/or structural integration of the floor slab would be required for this option. Other conditions of IBC Section 12.13.9 may apply to structural design.

5.2.2 Deep Foundations

The structure could potentially be built on deep foundations such as driven pipe piles which would develop capacity starting below 27 feet depth. Foundations supported on pile caps with driven piles would reduce and limit differential settlements to low levels, the foundation would have grade beams between pile caps that would help resist lateral movements.

5.2.3 Compaction Grouting

Most forms of liquefaction mitigation would not be cost effectiveness due to the depth of the liquefiable layer below the ground surface. Some methods such as deep dynamic compaction, transmit vibratory energy down from the surface to densely loose soil, and this energy would be dissipated by the shallow clay layers. Other methods involve driving heavy pile foundations or mandrils to improve the ground from near the surface, so that the method would either degrade or have no effect on the 20 feet of clay soils on the site.

Compaction grouting consists of placement of columns of stiff cement grout through a small diameter driven (e.g., 2 inch-diameter) casing where the grout is then expanded under pressure at the required depths. Pipe casings are driven from the ground surface to the desired bottom depth. Grouting is pumped in the casing until a minimum volume of grout is installed, until the maximum pressure is achieved, or grout returns to the surface. The grout pipe is pulled up to the next stage (typically 2 feet higher) and the process repeated until the entire layer is grouted. This is repeated for multiple grouting boreholes at approximately 6 to 8 feet on center. The grout expansion shears, compacts, and increases lateral pressures on the material between the multiple grouting boreholes so that they are no longer liquefiable. This method is appropriate for this site since it does not require any effort (other than driving the pipe) from the ground surface to 20 feet depth and this method is primarily effective with at least 15 feet of overburden.

5.3 Earthwork

5.3.1 General Site Grading

For the purposes of this report, soils with greater than 30 percent fines are either fine-grained or clay soils, and granular soils are those with less than 30 percent fines. Structural areas are portions of the site that will support the proposed structures, foundations, or pavements. Structural areas should be supported on dense native soils or compacted structural fill.

In general, existing native site soils are silty and/or clayey sands which are marginally suitable for direct support of structures and pavements. Existing native clay site soils are not suitable for re-use as structural fill unless inspection during construction shows materials are cleaner than average for the site. Materials could be reused locally if an inspector is present full time to determine which materials should be exported and which can be retained. Imported structural fill, where required, should be granular and free of organics and should meet the specifications presented in Table 2. All imported fill materials should be approved by the project engineer prior to being transported to the site.

TABLE 2 - GUIDELINE SPECIFICATION FOR IMPORTED STRUCTURAL FILL			
<u>Sieve Size</u>		<u>Percent by Weight Passing</u>	
4 Inch		100	
¾ Inch		70 – 100	
No. 4		35 – 90	
No. 40		10 – 65	
No. 200		5 – 30	
<u>Percent Passing</u>		<u>Maximum Liquid Limit</u>	<u>Maximum Plastic Index</u>
<u>No. 200 Sieve</u>			
5 – 20		40	15
21 – 30		30	10

Soils used for structural fill should be uniformly moisture conditioned to within 2 percent of optimum moisture content and placed in layers of eight inches or less in loose thickness. The lift should then be compacted with appropriate compaction equipment to achieve at least 90 percent relative compaction.

Prior to densification, the moisture content of the soils should be determined to evaluate the need for moisture conditioning. After the densification process, a firm, stable surface should be produced. No material should be placed, spread, or rolled while it is frozen or thawing, or during unfavorable weather conditions.

Oversize material (greater than 4 inches) should not be included in any structural fill that will support future structural loads except stabilizing fill as discussed below.

5.3.2 Remedial Earthwork

Marginal clay and clayey sand soils were found to exist from the ground surface down to at least 5 feet depth. The clay soils were classified as moist, very stiff, and as exhibiting low to medium plasticity. Laboratory testing performed on these materials indicates the some of the clay soils exhibit plasticity indices on the order of 27, indicative of moderate expansion potential (Nelson and Miller, 1992).

All clay soils should be removed from beneath structural areas, unless grading is such that those soils will be covered by at least 1 foot of structural fill beneath footings and 2 feet beneath slabs and pavements. The separation underneath slabs and pavements refer to the depth below the rigid (asphalt concrete/Portland cement concrete) layer and the thickness can include the thickness of the aggregate base layer. It must be emphasized that unless clay soils are completely removed from structural areas some differential movement should be anticipated. All over-excavation should be backfilled with structural fill to footing grade, or subgrade for pavements and slabs. The width of over-excavation in mass grading should extend at least 5 feet from the outline of the structure, or in fine grading should extend laterally from the edge of footings, slabs, or pavements at least one-half the depth of the over-excavation.

Clays to be left in place and covered with fill should be moisture-conditioned to 2 to 4 percent over optimum for a minimum depth of 12 inches. This moisture level will significantly decrease the magnitude of shrink-swell movements in the upper foot of clay. The high moisture content must be maintained by periodic surface wetting, or other methods, until the surface is covered by at least one lift of fill. If allowed to dry out, subsequent expansion of clay soils beneath foundations and floor slabs could significantly exceed the allowable design criteria identified in following sections.

Prior to fill placement, the exposed subgrade surfaces should be scarified to a minimum depth of six inches, moisture conditioned as necessary, and compacted to a minimum of 90 percent relative compaction in accordance with the ASTM D1557 compaction test method. Where less than 70 percent passes the 3/4-inch sieve, soils are too coarse for standard density testing techniques. In this case, as will likely occur here, proof rolling is recommended using a minimum of five single passes with a minimum 10-ton roller in mass grading, or five complete passes with hand compactors in footing trenches. Proof-rolling has proved to provide adequate project performance for coarse-grained soils, as long as all other geotechnical recommendations are closely followed. In all cases, the final surface should be smooth, firm, and exhibit no signs of deflection.

5.3.3 Stabilizing Fill

If construction occurs in wet weather, surface soils can be well above optimum moisture and impossible to compact. In some situations, moisture conditioning of the top 12 inches of subgrade may allow the soil to dry sufficiently to allow compaction. Where construction schedules preclude delays or drying is ineffective, mechanical stabilization will be necessary. Mechanical stabilization may be achieved by over-excavation and/or placement of an initial 12- to 18-inch-thick lift of 12-inch-minus, 3-inch-plus, well graded, angular rock fill. The more angular and well-graded the rock is, the more effective it will be. This fill should be densified with large equipment, such as a self-propelled sheepsfoot or a large loader, until no further deflection is noted. Additional lifts of rock may be necessary to achieve adequate stability. A test section to confirm performance of any planned stabilizing fill is recommended.

The use of a geotextile will prevent mud from pumping up between the rocks, thereby increasing rock-to-rock contact and decreasing the required thickness of stabilizing fill. The geotextile should meet or exceed the following minimum properties as stated in Table 3.

TABLE 3 - MINIMUM AVERAGE ROLL STRENGTH PROPERTIES FOR GEOTEXTILE	
Trapezoid Strength (ASTM D 4533)	80 lbs.
Puncture Strength (ASTM D 4833)	120 lbs.
Grab Tensile/Elongation (ASTM D 4632)	245 @ 50 %

As an alternate to rock fill, a geotextile/gravel system may be used for stabilization. Aggregate base, Class C or D drain rock, or pit run gravels should be placed above the geotextile. Regardless of which alternate is selected, a test section is recommended to determine the required thickness of stabilization.

5.3.4 Temporary Trench Excavation and Backfill

Based on the subsurface conditions encountered within our boreholes, we anticipate that excavations for footings and utility trenches can be made with conventional equipment. Shoring or sloping of trench walls deeper than 4 feet will be necessary to protect personnel and provide temporary stability. All excavations should comply with current OSHA safety requirements for Type C soils (Federal Register 29 CFR, Part 1926).

For the construction of underground utilities, pipe zone backfill (material beneath, and in the immediate vicinity of the pipe) should consist of clean, granular material free of clay and organic matter and be of a size such that 100 percent passes the ¾-inch sieve, not more than 10 percent passes a No. 200 sieve, and the material has a minimum sand equivalency of 30. Trench intermediate backfill (material placed between the pipe zone backfill and finished subgrade) may consist of native soil that is free of debris and organic matter and has a maximum particle size of 4 inches.

Backfill for trenches or other excavations within pavement areas, beneath slabs, and adjacent to foundations should be compacted in 6- to 8-inch layers with mechanical tampers. Jetting and flooding should not be permitted. We recommend all backfill be compacted to at least 90 percent relative compaction. The moisture content of compacted backfill soils should be within 2 percent of the optimum. Poor compaction in utility trench backfill may cause excessive settlements resulting in damage to the pavement structural section or other overlying improvements.

5.4 Seismic Design Parameters

The 2018 International Building Code (IBC), adopted by the City of Sparks, requires a detailed soils evaluation to a depth of 100 feet to develop appropriate seismic design criteria. Geophysical analyses of the upper 100 feet of subsurface soils were performed as described in the Section 2.33 ReMi Shear Wave Velocity Measurements of this report. The results of the analyses indicate average shear wave velocity of 1,203 feet per second in the upper 100 feet of the site soils. As a result, a Site Class C soil

would be applicable for the site. However, liquefiable conditions (Site Class F) are identified, unless the structure has a period of vibration of 0.5 seconds or less, in which case the usual site class method is applicable. Seismic design criteria for structures with a period of vibration of 0.5 second or less are provided on Table 4. If the structure period is greater than 0.5 seconds, then a ground motion hazard analysis would be required due to the liquefiable conditions.

TABLE 4 – SEISMIC DESIGN CRITERIA (2018 IBC/ASCE/SEI 7-16) FOR STRUCTURES WITH PERIOD OF VIBRATION OF 0.5 SECONDS OR LESS	
Approximate Latitude	39.525726
Approximate Longitude	-119.707176
Spectral Response Acceleration at Short Period S_s	1.504
Spectral Response Acceleration at 1-Second Period S_1	0.524
Site Class	C
Site Coefficient F_a , decimal (determined for Site Class C, per ASCE 7-16 section 11.48 Exception 1)	1.2
Site Coefficient F_v , decimal (determined for Site Class C, per ASCE 7-16 section 11.48 Exception 1)	1.476
Site Adjusted Spectral Response Acceleration at Short Periods S_{ms} ,	1.804
Site Adjusted Spectral Response Acceleration at Long Periods S_{m1} ,	0.773
Adjusted Peak Ground Acceleration, PGA_M	0.766

A ground motion hazard analysis would be required if the structural period is 0.5 seconds or longer. RTGA can perform this analysis upon request.

5.5 Shallow Foundations

Near-surface silts and clays are unfavorable foundation soils such that footings should not be founded directly in these materials. The most economical method of foundation support lies in spread footings bearing on a minimum of 2 feet of structural fill. The bottom of footing excavations should be recompacted to at least 90 percent relative compaction and should be firm and unyielding.

Exterior foundations must be embedded a minimum of 24 inches below lowest adjacent exterior finish grade for frost protection and confinement. Interior footings should be bottomed at least 12 inches below lowest adjacent finish grade for confinement. Wall foundation dimensions should satisfy the requirements listed in the latest edition of the International Building Code.

Foundations designed and constructed in accordance with the recommendations of this geotechnical report for the following bearing pressures:

TABLE 5 – ALLOWABLE BEARING PRESSURES	
<u>Foundation Width</u>	<u>Allowable Bearing Pressure</u>
< 3 feet with replacement of the upper 2 feet below the footings	2,000 psf
≥ 3 feet with replacement of the upper 2 feet below footings	2,500 psf

The allowable soil bearing pressures were calculated using a minimum embedment depth of 2 feet and a minimum foundation width of 2 feet or greater. The allowable bearing pressure may be increased by one-third for total loading conditions, including wind and seismic forces. To account for overturning, the design bearing pressure including overturning or load eccentricity should consider the bearing pressure over effective footing width and length, B* and L*:

$$B^* = B - 2 * e_B$$

$$L^* = L - 2 * e_L$$

Where B and L are the actual footing width and length, and e_B and e_L are the eccentricity of the load in length offset from the centerline of the footings. This method generally gives lower maximum applied pressures than computing the maximum edge load under trapezoidal or triangular loading.

Prior to placing steel or concrete, footing excavations should be cleaned of all debris, loose or soft soil, and water. Any loose soil in the bottom of footing excavations should be recompact to at least 90 percent relative compaction or removed to expose firm, unyielding material. All footing

excavations should be observed by the project soils engineer just prior to placing steel or concrete to verify the recommendations contained herein are implemented during construction.

5.6 Settlements

The upper 5 to 20 feet of soil at the site includes soils that have potential for significant settlement. Total settlement of an individual foundation will vary depending on the plan dimensions of the foundation and the actual load supported. Consolidation settlements were calculated based on soil parameters developed on nearby sites to the southeast and soil undrained strengths obtained from pocket penetrometer testing of samples in the boreholes. Elastic settlement, or settlement of unsaturated clay soils, will occur as the building loads are applied. The consolidation settlement will require dissipation of excess pore pressure to occur over time. Soils are expected to remain in the over-consolidated stress range even after building construction. Secondary or creep settlement primarily occurs in normally consolidated soils, so secondary settlement is considered to be negligible.

A summary of anticipated settlements based on footing size for 2,500 psf bearing pressure is provided in Table 6. If 2 feet or more of fill is placed relative to the existing ground surface, the settlement would be additional to the settlement that would occur due to footings at the same location.

TABLE 6 – SETTLEMENT SUMMARY	
<u>Footing Size</u>	<u>Calculated Settlement</u> <u>(inches)</u>
11 ft X 11 ft w/ 2500 psf Bearing Pressure	1.0
8 ft X 8 ft w/ 2500 psf Bearing Pressure	0.9
2 ft strip w/ 2500 psf Bearing Pressure	0.8
Placement of 2 feet of fill	0.3

In our experience, soils in western Nevada do not always settle as slowly as indicated by consolidation theory and testing. This is because many clays are deposited subaerially or are deposited with occasional periods of drying that can result in cracking or other macrostructure. These features greatly increase vertical occurrence of drainage paths, which speeds the rate of drainage compared to

testing of intact small-scale consolidation test samples. Settlement is expected to be relatively rapid as the upper soil layers are unsaturated and over-consolidated. Settlement under columns or footings is expected to be largely complete once loads are fully placed. Settlement under wide-area placement of fills is expected to take one or more months to complete.

5.7 Alternate Foundations – Driven Pipe Piles

Plate 18 shows plots of allowable compressive capacity versus depth for 12-inch-diameter closed-end steel pipe piles. During and following an earthquake with liquefaction, the piles would be subject to down drag due to the liquefied soils settling and reversing the skin friction on the sides of the piles. We recommend a minimum pile length of 38 feet below existing ground surface to allow for lateral fixity below the liquefiable layer. Assuming dead plus normal live loading in the range of 80 kips per pile minimum, a pile length of 10 feet below bottom of liquefiable deposits or 38 feet would be sufficient.

Lateral pile capacity can be provided for these piles if this alternative is selected. Settlement of pile foundations will be less than ½ inch under static and/or liquefiable conditions.

5.8 Short Retaining Walls

Short retaining walls less than 4 feet tall, including loading dock foundations with imbalanced ground levels and utility vaults/sumps, should be designed to resist the lateral earth pressure exerted by the retained, compacted backfill plus any additional lateral force that will be applied to the wall due to surface loads placed at or near the wall. The following table presents a list of recommended soil parameters for the design of these small retaining structures of less than 4 feet in retained height assuming vertical back faces and a level backfill.

TABLE 7 – LATERAL EARTH PRESSURES	
<u>Earth Pressure</u>	<u>Equivalent Fluid Density</u>
Active	30 pcf
At-rest	50 pcf
Seismic Active Pressure	75 pcf
Allowable Passive	450 pcf
Allowable Coefficient of Friction	0.45

The at-rest earth pressure is applicable for braced walls that are restrained at the top, including building walls or vaults. Fifty percent of any uniform area surcharge placed at the top of a restrained wall may be assumed to act as a uniform horizontal pressure over the entire height of the wall. Where rotational movement is possible, the active earth pressure applies. Thirty percent of any uniform surcharge placed at the top of a non-restrained wall may be assumed to act as a uniform horizontal pressure over the entire height of the wall. The seismic active pressure, if larger than the at-rest pressure, applies to both active- and at-rest walls during earthquake conditions.

Resistance to lateral loads may be provided by frictional resistance between the bottom of concrete foundations and the underlying soils and by passive soil pressure against the sides of the foundations. Both allowable passive and frictional resistances may be assumed to act concurrently. The seismic active pressure is used for either active or at-rest walls for earthquake loading.

The above values are for horizontal backfill and do not include hydrostatic pressures that might be caused by groundwater or surface water trapped behind a structure. Therefore, wall backfill should be free draining and provisions should be made to collect and dispose of excess water that may accumulate behind earth retaining structures.

5.9 Concrete Slab-on-Grade Construction

Prior to constructing concrete floors, slabs, walkways, or other flatwork, the upper 8 inches of slab subgrade should be scarified, uniformly moisture conditioned to within 2 percent of optimum moisture content, and uniformly compacted to at least 90 percent relative compaction. At least 4 to 6 inches of Type 2 aggregate base (for interior and exterior slabs, respectively) should be placed beneath concrete slab-on-grade to provide uniform support. The aggregate base should be compacted to a minimum of 95 percent relative compaction. The subgrade should be protected against drying until the concrete slab is placed. Scarification and compaction may not be required if slabs are to be placed directly on previously approved, unfrozen, undisturbed compacted structural fill.

Interior concrete floor slabs should have a minimum thickness of 4 inches, and bus maintenance areas of at least 6 inches. Slab thickness and structural reinforcing requirements within the slab should be determined by the design engineer. In floor slab areas where moisture-sensitive floor coverings are planned, an impermeable membrane (e.g., 15-mil Stego wrap or approved alternate) should be

installed to reduce the migration of moisture vapor through the concrete slabs. Installation should conform to the specifications provided for a Class B vapor restraint (ASTM E 1745 and 1643).

Modulus of subgrade reaction (K) is a measure of the displacement vertical pressure per unit foot. It is used primarily for rigid pavement design and estimates the support of the layers below basecourse and pavement layers. The modulus for this site is estimated to be 100 pounds per square inch per inch of settlement for concrete slabs-on-grade or 170 kips per cubic foot.

5.10 Pavement Sections

Pavement design is mostly a function of heavy bus or truck traffic and dynamic subgrade strength. Dynamic strength was determined from the R-value test (ASTM D2844). The current design methods use Resilient Modulus (M_r) which can be correlated from R-value. Two R-value samples were submitted for analysis. One sample, referred to as Composite sample, was formed from cuttings collected from boreholes B-1, B-4, B-7, and B-8. A second R-value sample was collected from borehole B-3. Results of R-value sample analyses are presented as Plates 15 and 16.

The Composite sample, collected from primarily from native soils, was collected from depth ranging from 1 to 5 feet below surface. Analysis of this sample resulted in an R-value of 22. The R-value sample from borehole B-3 was collected between the surface and 5 feet depth from near-surface granular soils (presumed to be fill) under the existing parking lot area near the center of the site. Analysis of the B-3 sample resulted in an R-value of 37.

We have developed recommendations for pavement section based on the lower R-value using the Asphalt Institute (1991) method. We assumed there will be approximately 260 bus parking spaces for 12-ton school busses, and there will be, on average, four (4) trips per weekday or 5,120 trips per week. For a 20-year design life, there would be 1.4 million equivalent single axle loads on the primary driveways in and out of the facility. For this loading, paved areas subject to concentrated bus traffic should consist of 7 inches of asphalt concrete underlain by 12 inches of Type 2, Class B, aggregate base, or 6 inches of asphalt concrete underlain by 14 inches of aggregate base. Paved areas restricted to bus parking (or less than about 20 percent of the maximum traffic above near the entrances, such as the rear parking lots) can consist of 5 inches of asphalt concrete underlain by 10 inches of aggregate base.

If the traffic ultimately exceeds the anticipated levels, it may be necessary to reevaluate and overlay the pavement at some time in the future.

5.11 Pavement Drainage Design Parameters

Inherent in the selection of design subgrade strength is the assumption that the subgrade will not become saturated. Subgrade strength drops dramatically when moisture increases even slightly more than the selected design value. This is essentially true for any material other than clean sands and gravels and is more critical in fine-grained and clay soils than in granular soils. Soils at this site are considered to be of moderate moisture sensitivity. Where irrigated landscaping is to be placed adjacent to the heavily-driven roadways or driveways, we recommend that edge drains be constructed directly behind the curb, or along the edge of the asphalt where curbs and gutters are not used. If proper drainage is not provided, increased maintenance costs and premature pavement (subgrade) failure will result.

The edge drain should extend at least 12 inches below the pavement subgrade and can consist of either a narrow trench backfilled with Class B or C drain rock, or a synthetic edge drain product such as Mirdrain HC or approved alternate. Drain rock should be separated from native soil backfill by a geotextile such as Mirafi® 140N or equal. The edge drain should be tied into the storm drain or drain rock backfill around the storm drain. In some cases, utility trenches located behind the street could be utilized as edge drains, if designed and constructed with that intent. For extensive center-of-pavement gutters, a subsurface perforated drainpipe should also be considered below the aggregate base section which would tie into the drain rock around the nearest drain inlet, to collect and remove water which may penetrate through cracks around the gutter or water that otherwise infiltrates under the low point of the pavement.

Based on our experience in Northern Nevada, environmental aspects, such as freeze-thaw cycles and thermal cracking will probably govern the life of AC pavements. Thermal cracking of the asphalt pavement allows more water to enter the pavement section, which promotes deterioration and increases maintenance costs. A program of repair including periodic crack and joint sealing should be considered for project maintenance and design starting five to eight years after initial construction.

5.9 Erosion and Sediment Control

Erosion potential is dependent on numerous factors including grain size distribution, cohesion, moisture content, slope angle, and the velocity of the water or wind on the ground surface. Erosion and sediment control should be incorporated in construction and post-construction phase planning. In general, all runoff should be temporarily directed around construction sites. Temporary control measures designed to be effective during construction should be maintained through the course of the work. When necessary, these measures may be left in place along with permanent measures during post construction period until effective landscaping or revegetation has been established. Permanent vegetation consisting of native species should be established where possible and natural vegetation should be protected and retained where possible. Clayey topsoil and natural organic debris should be stockpiled for use in revegetation or removed from site.

There are no major cut or fill slopes planned for this project. Dust potential at this site will be moderate during dry periods. Temporary (during construction) and permanent (after construction) erosion control will be required for all disturbed areas. The contractor shall prevent dust from being generated during construction in compliance with all applicable city, county, state, and federal regulations. The contractor shall submit an acceptable dust control plan to the City of Sparks prior to starting site preparation or earthwork. Project specifications should include an indemnification by the contractor of the owner and engineer for any dust generation during the construction period. The owner will be responsible for mitigation of dust after accepting the project.

To minimize erosion and downstream impacts to sedimentation from this site, best management practices with respect to storm water discharge should be implemented at this site.

5.12 Site Drainage and Moisture Protection

Final elevations at the site should be planned so that drainage is directed away from all foundations. A system of roof gutters and drains is recommended to collect the roof drainage and direct it away from foundations unless pavement extends to the walls. No water ponding should be allowed within five feet of the building perimeter. Any surface water should be re-routed and directed to non-sensitive areas away from the building.

5.13 Corrosion

Analytical testing was conducted on a representative near-surface soil sample obtained from 2.5 to 4 feet in borehole B-3 to assess the potential for adverse reactivity with concrete and corrosivity with steel. The tested soil sample indicated 1,600 mg/kg for sulfate. Chloride content was low at 13 mg/kg. Resistivity was severely corrosive at 650 ohm-cm, and pH was essentially neutral at 7.68 pH units. Type V cement should be used in concrete for this project where concrete is in contact subsurface soils. The resistivity value indicates a severe corrosion potential for ferrous metals in direct contact with on-site soils. Therefore, special corrosion mitigation measures such as cathodic protection should be implemented for buried steel pipes and helical piers. The test results are presented on Plate 17.

6.0 ADDITIONAL SERVICES

6.1 Plan Review, Construction Observation, and Testing

We recommend that RTGA conduct a general review of the project plans, including subsurface drainage systems and specifications to verify our earthwork and foundation recommendations have been properly interpreted and implemented during design. In addition, the recommendations made in this report assume that an adequate program of tests and observations will be made during construction to verify compliance with these recommendations. These tests and observations should include, but not necessarily be limited to, the following:

- Observations and testing during site preparation and earthwork;
- Observations and testing during structural fill compaction;
- Observation during pile driving or ground improvement if utilized;
- Observation and testing of construction materials (concrete, steel and wood); and
- Consultation as may be required during construction.

Additional information concerning the scope and cost of these services can be obtained from our office.

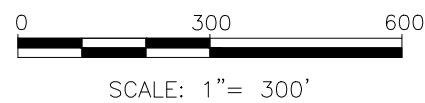
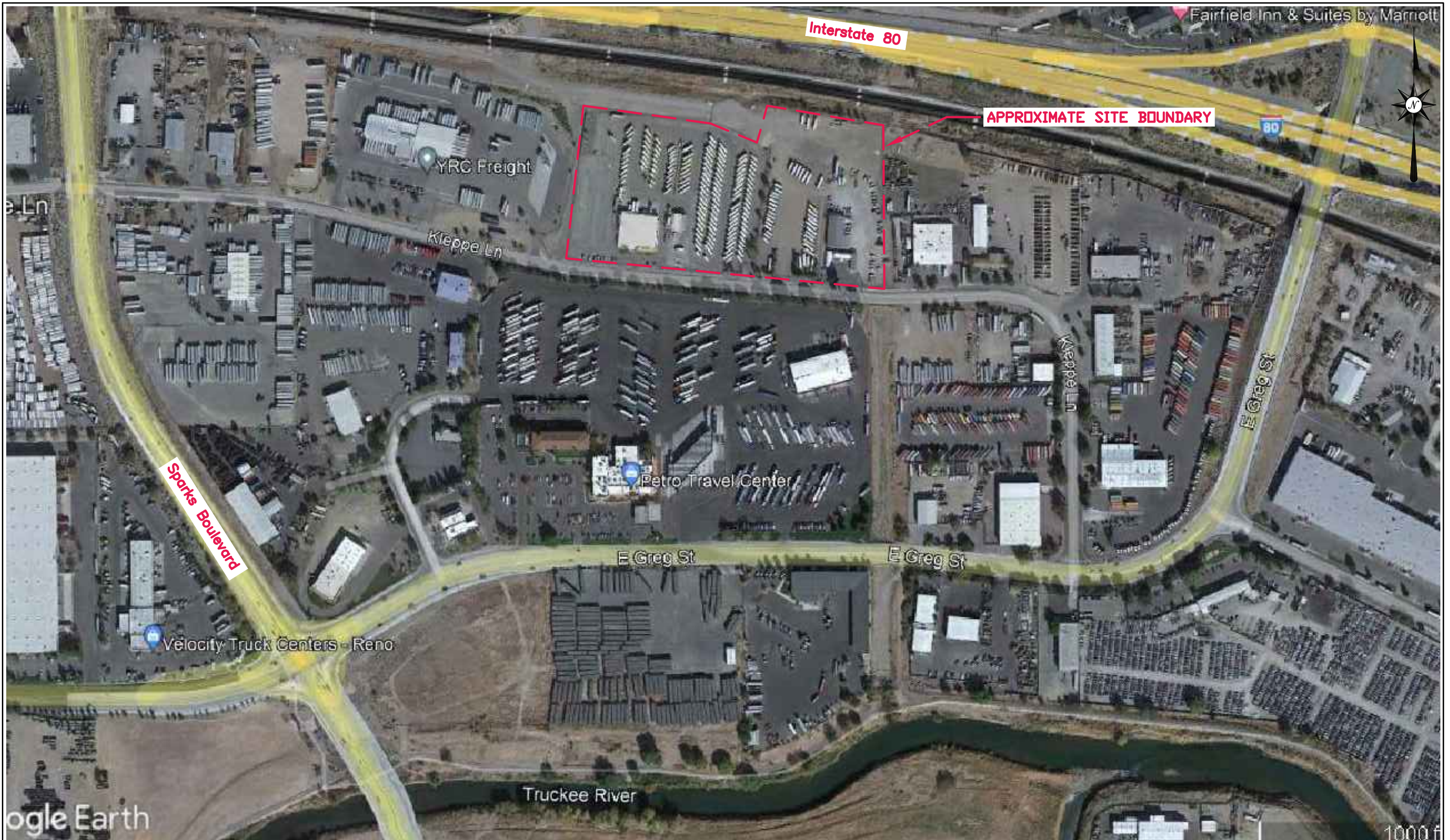
7.0 LIMITATIONS

Recommendations contained in this report are based on our field exploration, and our understanding of the proposed construction. This report has been prepared for design purposes for specific application to the currently proposed subject project in accordance with the generally accepted standards of practice at the time the report was written. No warranty, expressed or implied, is made.

The analyses and recommendations submitted are based on the field exploration performed at the locations shown on Plate 2 of this report. This report may not reflect the soil variations that may be encountered during construction. Therefore, further evaluation of site conditions may be warranted during construction.

If the scope of the proposed construction changes from those described, our recommendations should be reviewed by us and may require modification. All parties to the project including the designer, contractor, subcontractors, etc., should be made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the Contractor's option and risk.

PLATES



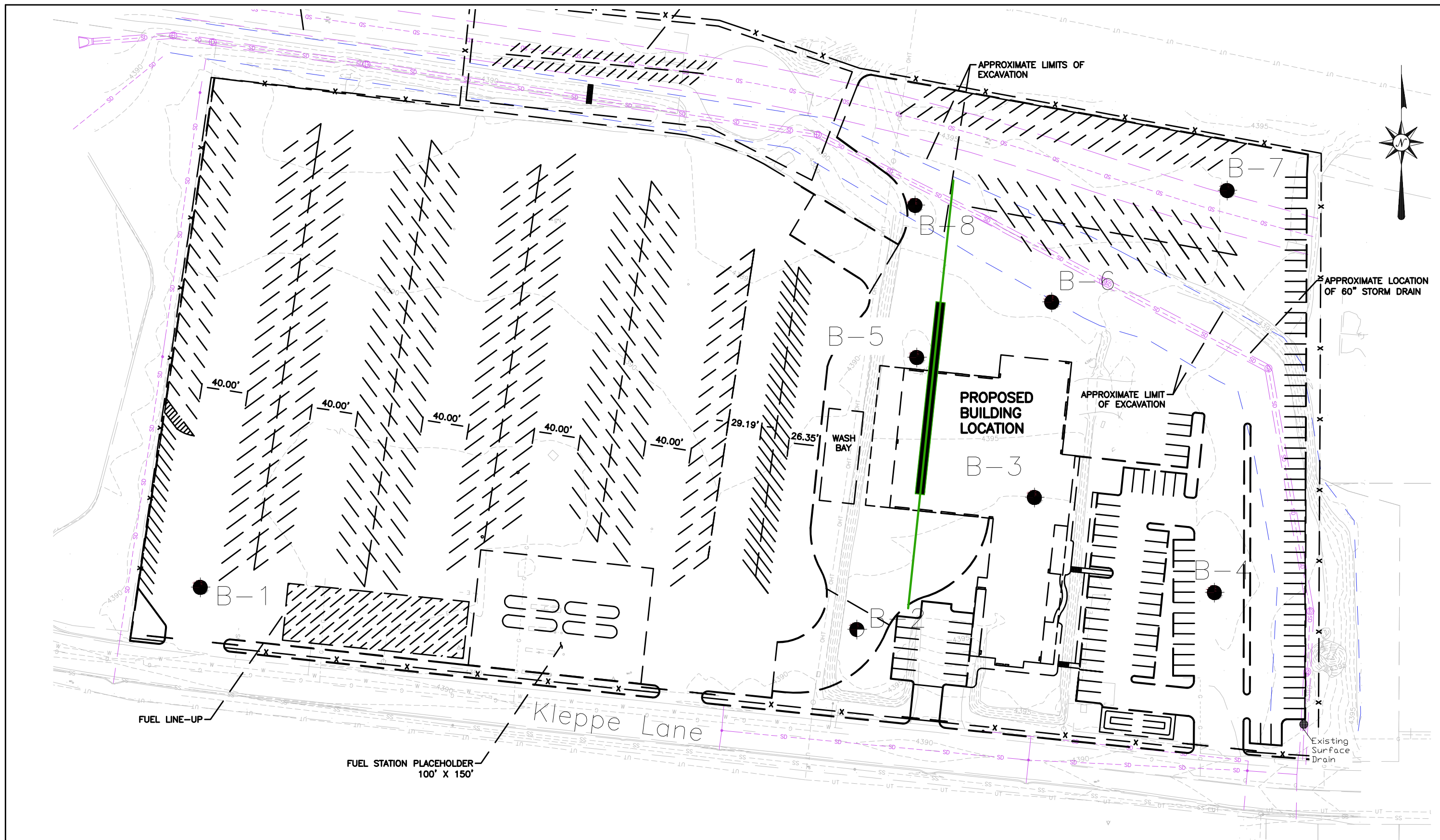


Reno Tahoe Geo Associates, Inc.
P.O. Box 18449
Reno, Nevada 89511

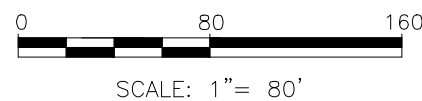
CONSULTING CIVIL ENGINEERS
TEL (775)853-9100
FAX (775)853-9199

JOB # 22034.001 APPR: _____ DATE: 4/5/2022

SITE VICINITY		PLATE
GEOTECHNICAL INVESTIGATION WCSD BUS FACILITY 1850 KLEPPE LANE - SPARKS		1
WASHOE COUNTY		NEVADA



● Approximate Borehole Location



ReMi Profile - Thick Portion of Line Shows Extent of 2-D Profile

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P.O. Box 18449 Reno, Nevada 89511	TEL (775)853-9100 FAX (775)853-9199	
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SITE PLAN		PLATE
GEOTECHNICAL INVESTIGATION WCSD BUS FACILITY 1850 KLEPPE LANE - SPARKS		2
WASHOE COUNTY	NEVADA	

LOG OF BORING B-1

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/22/22

LABORATORY TESTS

Resistance R-Value
Exudation Pressure at 300
Psi = 22
Percent Passing #200 = 43%

FIELD BLOWS
/6in
BLOWS/FT
MOISTURE
CONTENT (%)
DRY DENSITY
(pcf)

DEPTH (ft)
SAMPLE

0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Asphalt Pavement

GRAVELLY SILTY SAND (SM)

FILL Orange, brown, slightly moist, medium dense, fine to coarse angular to subrounded gravel, non-plastic silt, in fine to coarse sand. (est.20% G/ 65% S/ 15% F)

CLAYEY SAND WITH GRAVEL (SC)

Black, brown, moist, loose, medium plasticity fines in fine to medium sand. (est.18% G/ 39% S/ 43% F)

(est.40% F)

TERMINATED @ 6.5'

No Free Water Observed



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LOG OF BORING B-1

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

3

LOG OF BORING B-2

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION DATE 4/19/22

LABORATORY TESTS

SA, Percent Passing #200
=31%

FIELD BLOWS /6in	BLOWS/FT	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DEPTH (ft)	SAMPLE
9 16 13	29	11.5		0	
9 10 11	21			2	
10 11 15	26			4	
3 6 7	13			6	
3 3 4	7			8	
3 3 3	6			10	
3 4 5	9			12	
				14	
				16	
				18	
				20	

SILTY GRAVEL (GM) FILL; Brown, black, grey, medium dense, slightly moist, fine to coarse sand, non-plastic fines, in fine to coarse angular to subrounded gravel. (est.20% F)
CLAYEY SAND WITH GRAVEL (SC) FILL; Brown, slightly moist, medium dense, angular fine to coarse gravel, low plasticity fines, in fine to coarse sand. (est.20% G/ 49% S/ 31% F) Pocket Penetrometer = 1.5 tsf.
CLAYEY SAND (SC) FILL; Brown, slightly moist, medium dense, medium plasticity fines in fine to coarse sand. Minor fine to coarse angular gravel. (est.5% G/ 55% S/ 40% F)
CLAYEY SAND (SC) Brown to grey, moist, low to medium plasticity fines in fine to coarse sand. Some thinly bedded sand and clay layers. (est.40% F)
CLAYEY SAND (SC) Brown, moist, loose, low plasticity fines in fine to medium sand. Occasional roots. (est.30% F)
POORLY GRADED SAND WITH SILT (SP-SM) Brown to light brown, firm, slightly moist, fine to medium sand in non-plastic silt. (est.80% F)
LEAN CLAY (CL) Greenish grey, brown, moist, stiff, fine to medium sand in medium plasticity clay. (est.80% F)



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LOG OF BORING B-2

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

4

1 of 2

LOG OF BORING B-2

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/19/22

LABORATORY TESTS

Percent Passing #200 = 9%

FIELD BLOWS /6in	BLOWS/FT	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DEPTH (ft)	SAMPLE
4 5 6	11			20	
				22	
				24	
2 4 5	9	23.6		26	
				28	
21 37 24	61			30	
				32	
				34	
				36	
				38	
				40	

LEAN CLAY (CL)
Greenish grey, stiff, moist, fine to medium sand in medium plasticity clay.
(est.80% F) (continued)

WELL GRADED SAND (SW)
Grey, black, wet, loose, fine to coarse sand with non-plastic silt and fine subangular to subrounded gravel.
(est.20% G/ 65% S/ 15% F)

Pushed Shelby Tube #150/18". No Recovery.

POORLY GRADED SAND (SP)
Black, wet, fine to coarse sand with minor non-plastic silt.
(est.5% G/ 86% S/ 9% F)

WELL GRADED SAND WITH CLAY (SW-SC)
Grey, black, wet, loose, fine to coarse gravel and non-plastic fines in fine to coarse sand.
(est.20% G/ 65% S/ 15% F)

WELL GRADED SAND (SW)
Grey, black, wet, dense, fine to coarse sand with non-plastic silt and fine subangular to subrounded gravel.
(est.20% G/ 65% S/ 15% F)

Noticeably harder drilling below 28 feet.

TERMINATED @ 31.5'



P. O. Box 18449
Reno, Nevada 89511

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FAX (775) 853-9199

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LOG OF BORING B-2

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

4

2 of 2

LOCATION APN: 034-164-06ELEVATION _____ DATE 4/19/22

FIELD BLOWS
/6in
BLOWS/FT
MOISTURE
CONTENT (%)
DRY DENSITY
(pcf)

Case	Number of nodes	Number of elements	Number of degrees of freedom	Number of unknowns	Number of iterations	Number of iterations per element	Number of iterations per node	Number of iterations per degree of freedom	Number of iterations per unknown
10	10	10	12	22	9.1				
6	32	27	59	15.9					
9	9	11	20						
4	4	6	10						
3	4	5	9						
2	4	5	9						

Grey, moist to wet, loose, non-plastic silt in fine to coarse sand.
(est.20% F)



1 of 2

LOG LETTER SIZE WCSD SPARKS BUS FACILITY.GPJ MED DATA TEMPLATE 2015A.GDT 5/23/22

LOG OF BORING B-3

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/19/22

LABORATORY TESTS

FIELD BLOWS
/6in

BLOWS/FT

MOISTURE
CONTENT (%)

DRY DENSITY
(pcf)

DEPTH (ft)

SAMPLE

20

22

24

26

28

30

32

34

36

38

40

LEAN CLAY (CL)

Greenish grey, moist, stiff clay with fine to medium sand.
(est.60% F) (continued)

Pocket Penetrometer = 2.5 tsf.

POORLY GRADED SAND (SP)

Greenish grey, wet, fine to coarse sand, rare subangular fine to medium gravel in non-plastic to low plasticity fines.
(est.5% G/ 80% S/ 15% F)

SILTY SAND (SM)

Greenish grey, wet, fine to coarse sand, subangular fine to coarse gravel, non-plastic fines in fine to coarse sand.
(est.20% G/ 65% S/ 15% F)

TERMINATED @ 26.5'



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JOB # 22034.001 APPR: _____ DATE: 5/5/2022

LOG OF BORING B-3

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

5

2 of 2

LOG OF BORING B-4

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/22/22

LABORATORY TESTS

FIELD BLOWS
/6in

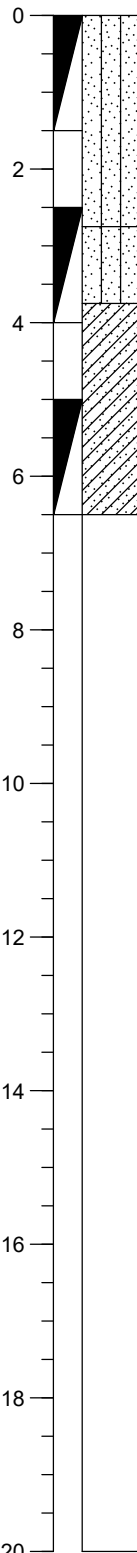
BLOWS/FT

MOISTURE
CONTENT (%)

DRY DENSITY
(pcf)

DEPTH (ft)

SAMPLE



GRAVELLY SILTY SAND (SM)
Brown, dry, medium dense, angular to subrounded fine to coarse gravel, non-plastic fines, fine to medium sand.
(est.10% G/ 60% S/ 30% F)

SILTY SAND (SM)
Brown, slightly moist, loose, non-plastic fines in fine to medium sand.
(est.20% F)

CLAYEY SAND (SC)
Brown, moist, loose, medium plasticity fines in fine to medium sand.
(est.30% F)

(est.40% F)

TERMINATED @ 6.5'

No Free Water Observed

1 LOG LETTER SIZE WCSD SPARKS BUS FACILITY.GPJ MED DATA TEMPLATE 2015A.GDT 5/23/22



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LOG OF BORING B-4

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

6

LOG OF BORING B-5

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/19/22

LABORATORY TESTS

SA, Percent Passing #200
=35%

FIELD BLOWS /6in	BLOWS/FT	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DEPTH (ft)	SAMPLE
6 8 15	23	13.3		0	
8 8 9	17			2	
6 9 12	21			4	
5 7 10	17			6	
3 3 3	6			8	
3 4 1	5			10	
				12	
				14	
				16	
				18	
				20	

SILTY SAND (SM)
FILL; Brown, orange, medium dense, slightly moist, fine to coarse angular to subangular gravel, medium plasticity fines, fine to coarse sand.
(est.20% G/ 60% S/ 20% F)

CLAYEY SAND WITH GRAVEL (SC)
FILL; Brown, slightly moist, medium dense, non-plastic to low plasticity fines in fine to medium sand.
(est.19% G/ 46% S/ 35% F)

LEAN CLAY (CL)
Black to 8' then greenish grey, slightly moist, stiff, fine sand in low to medium plasticity clay.
(est.70% F)

Pocket Penetrometer = 2.5 tsf.

LEAN CLAY (CL)
Brown to greenish grey, moist, firm, fine sand in medium plasticity clay.
(est.80% F)

Pocket Penetrometer = 1.5 tsf.



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LOG OF BORING B-5

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

7

1 of 2

LOG OF BORING B-5

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/19/22

LABORATORY TESTS

Percent Passing #200 = 78%

FIELD BLOWS
/6in

BLOWS/FT

MOISTURE
CONTENT (%)

DRY DENSITY
(pcf)

4
6
6

12

31.1

2
9
13

22

12
18
23

41

DEPTH (ft)

SAMPLE

20

22

24

26

28

30

32

34

36

38

40

SANDY LEAN CLAY (CL)
Brown to greenish grey, moist to wet, stiff, fine sand in medium plasticity clay.
(est.78% F) (continued)

Pocket Penetrometer = 3.5 tsf.
GRAVELLY CLAYEY SAND (SC)
Grey, wet, medium dense, subrounded fine to coarse subangular to subrounded gravel and low to medium plasticity fines in fine to coarse sand.
(est.20% G/ 45% S/ 35% F)

WELL GRADED SAND (SW)
Grey, wet, dense, subrounded fine to coarse subangular to subrounded gravel and non-plastic silt in fine to coarse sand.
(est.25% G/ 65% S/ 10% F)

TERMINATED @ 26.5'



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LOG OF BORING B-5

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

7

2 of 2

LOG OF BORING B-6

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/19/22

LABORATORY TESTS

Percent Passing #200 = 24%

Liquid Limit = 40
Plasticity Index = 23

FIELD BLOWS /6in	BLOWS/FT	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DEPTH (ft)	SAMPLE
				0	
				2	
4 3 4	7	8.6		4	
				6	
3 2 4	6			8	
4 4 5	9			10	
3 4 4	8			12	
2 2 3	5			14	
1 2 4	6			16	
2 1 2	3			18	
				20	

SILTY SAND WITH GRAVEL (SM)
FILL; Brown, orange, medium dense, slightly moist, fine to coarse angular to subangular gravel, medium plasticity fines, fine to coarse sand.
(est.21% G/ 55% S/ 24% F)

LEAN CLAY (CL)
Greenish grey, slightly moist, firm fine sand in medium plasticity clay.
(est.70% F)

SILTY SAND (SM)
Grey, slightly moist, loose, non-plastic silt in fine to medium sand.
(est.20% F)

LEAN CLAY (CL)
Brown to greenish grey, slightly moist, firm, fine sand in medium plasticity clay.
(est.70% F)

Pocket Penetrometer = 1.5 tsf.

FAT CLAY (CH)
Greenish grey, moist, firm, fine sand in medium to high plasticity clay.
(est.80% F)

Pocket Penetrometer = 1.25 tsf.

LEAN CLAY (CL)
Greenish grey, wet, soft to firm, fine sand in medium to high plasticity clay. Fines decreasing to 50% below 20 feet.
(est.70% F)

Pocket Penetrometer = 1.0 tsf.



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LOG OF BORING B-6

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

8

1 of 2

LOG OF BORING B-6

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/19/22

LABORATORY TESTS

FIELD BLOWS /6in	BLOWS/FT	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DEPTH (ft)	SAMPLE
3 2 5	7			20	
				22	
				24	
				26	
				28	
				30	
				32	
				34	
				36	
				38	
				40	

LEAN CLAY (CL)

Greenish grey, wet, soft to firm, fine sand in medium to high plasticity clay. Fines decreasing to 50% below 20 feet.
(est.70% F) (continued)

Pocket Penetrometer = 0.75 tsf.

TERMINATED @ 21.5'

No Free Water Observed



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LOG OF BORING B-6

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

8

2 of 2

LOG OF BORING B-7

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/22/22

LABORATORY TESTS

FIELD BLOWS /6in	BLOWS/FT	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	DEPTH (ft)	SAMPLE
9 7 6	13			0	
3 3 4	7			2	
3 50/1"	50/1"			4	
				6	
				8	
				10	
				12	
				14	
				16	
				18	
				20	

GRAVELLY CLAYEY SAND (SC)

Brown, slightly moist, medium dense, angular to subrounded fine to coarse gravel, medium plasticity clay in fine to coarse sand. Thinly bedded formation.
(est. 15% G/ 55% S/ 30% F)

CLAYEY SAND (SC)

Brown, moist, loose, rare subangular to subrounded fine to coarse gravel, medium plasticity clay in fine to medium sand.
(est. 40% F)

LEAN CLAY (CL)

Brown, moist, soft, fine sand in medium plasticity clay.
(est. 70% F)

TERMINATED @ 6'

Sampler Refusal At 6 Feet
No Free Water Observed



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LOG OF BORING B-7

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

9

LOG OF BORING B-8

LOCATION APN: 034-164-06

EQUIPMENT CME 550

ELEVATION _____ DATE 4/22/22

LABORATORY TESTS

FIELD BLOWS
/6in

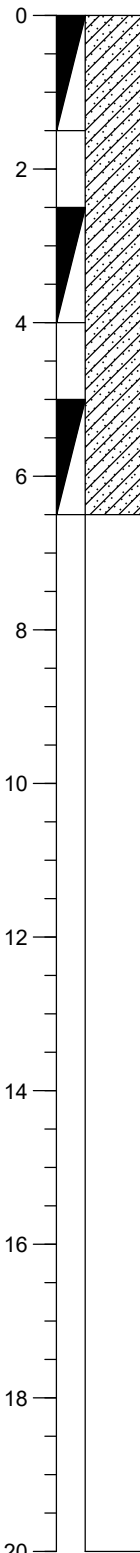
BLOWS/FT

MOISTURE
CONTENT (%)

DRY DENSITY
(pcf)

DEPTH (ft)

SAMPLE



GRAVELLY CLAYEY SAND (SC)
Brown, slightly moist to moist, medium dense, angular to subangular fine to coarse gravel, medium plasticity clay in fine to coarse sand.
(est.20% G/ 60% S/ 20% F)

(est.10% G/ 60% S/ 30% F)

(est.20% G/ 50% S/ 30% F)

TERMINATED @ 6.5'

No Free Water Observed



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LOG OF BORING B-8

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS



















PLATE

10

WASHOE COUNTY

NEVADA

UNIFIED SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			TYPICAL NAMES		
COARSE GRAINED SOILS	GRAVELS More than half coarse fraction is larger than No.4 sieve size	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS, GRAVEL SAND MIXTURES
			GP		POORLY GRADED GRAVELS, GRAVEL SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM		SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC		CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
	SANDS More than half coarse fraction is smaller than No.4 sieve size	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS
			SP		POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM		SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC		CLAYEY SANDS, POORLY GRADED SAND-SILT MIXTURE
FINE GRAINED SOILS	SILTS AND CLAYS Liquid limit less than 50	ML		INORGANIC SILTS & VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
		CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
		OL		ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	SILTS AND CLAYS Liquid limit greater than 50	MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	
		CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
		OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
HIGHLY ORGANIC SOILS		Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS	
ROCK				COBBLES/BOULDERS	
				GRANITIC BEDROCK	
				VOLCANIC BEDROCK	

KEY TO TEST DATA

LL	- Liquid Limit (in %)	Tx	320 (2600)	Unconsolidated Undrained Triaxial
PL	- Plastic Limit (in %)	TxCU	320 (2600)	Consolidated Undrained Triaxial
Gs	- Specific Gravity	UC	2000	Unconfined Compression
SA	- Sieve Analysis			
Consol	- Consolidation	DS	36° 400	Consolidated Drained Direct Shear

Shear Strength, psf
 Confining Pressure, psf
 Friction Angle; Cohesion, psf

SAMPLE DESIGNATION



STANDARD PENETRATION TEST SAMPLE
2½" OD MODIFIED CALIFORNIA SAMPLE
3" OD MODIFIED CALIFORNIA SAMPLE



SHELBY TUBE SAMPLE
AUGER CUTTINGS SAMPLE
LOCATION OF ROCK CORING



OTHER "UNDISTURBED" SAMPLE
OTHER BULK OR CLASSIFICATION SAMPLE

KEY TO SYMBOLS



OBSERVED WATER LEVEL



P.O. Box 18449
Reno, Nevada 89511

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UNIFIED SOIL CLASSIFICATION SYSTEM

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

PLATE

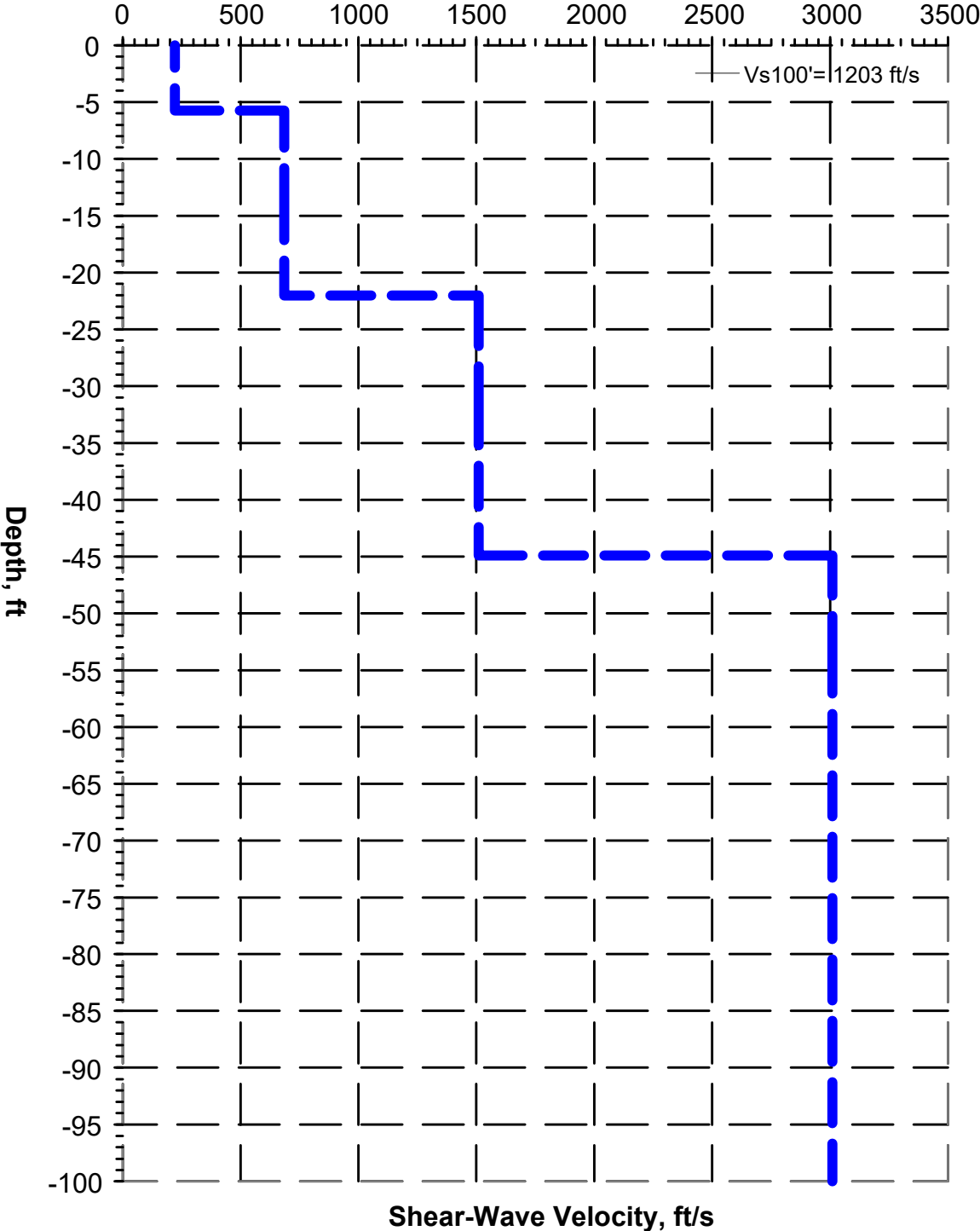
11

JOB # **22034.001** APPR: **JWP** DATE: **5/10/2022**

WASHOE COUNTY

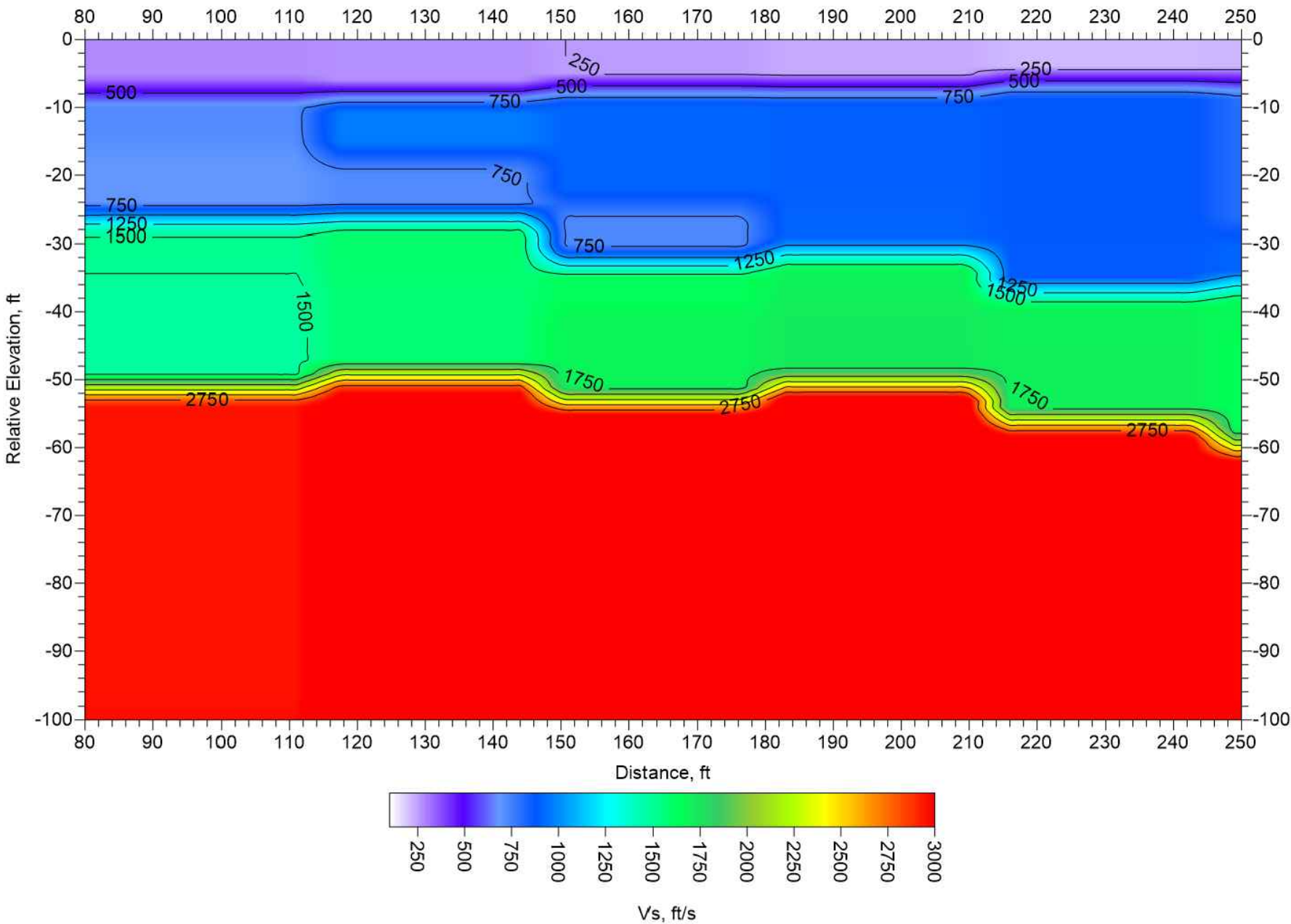
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WCSD Bus Facility: 1D Vs Model



South

North





Reno Tahoe Geo Associates, Inc.
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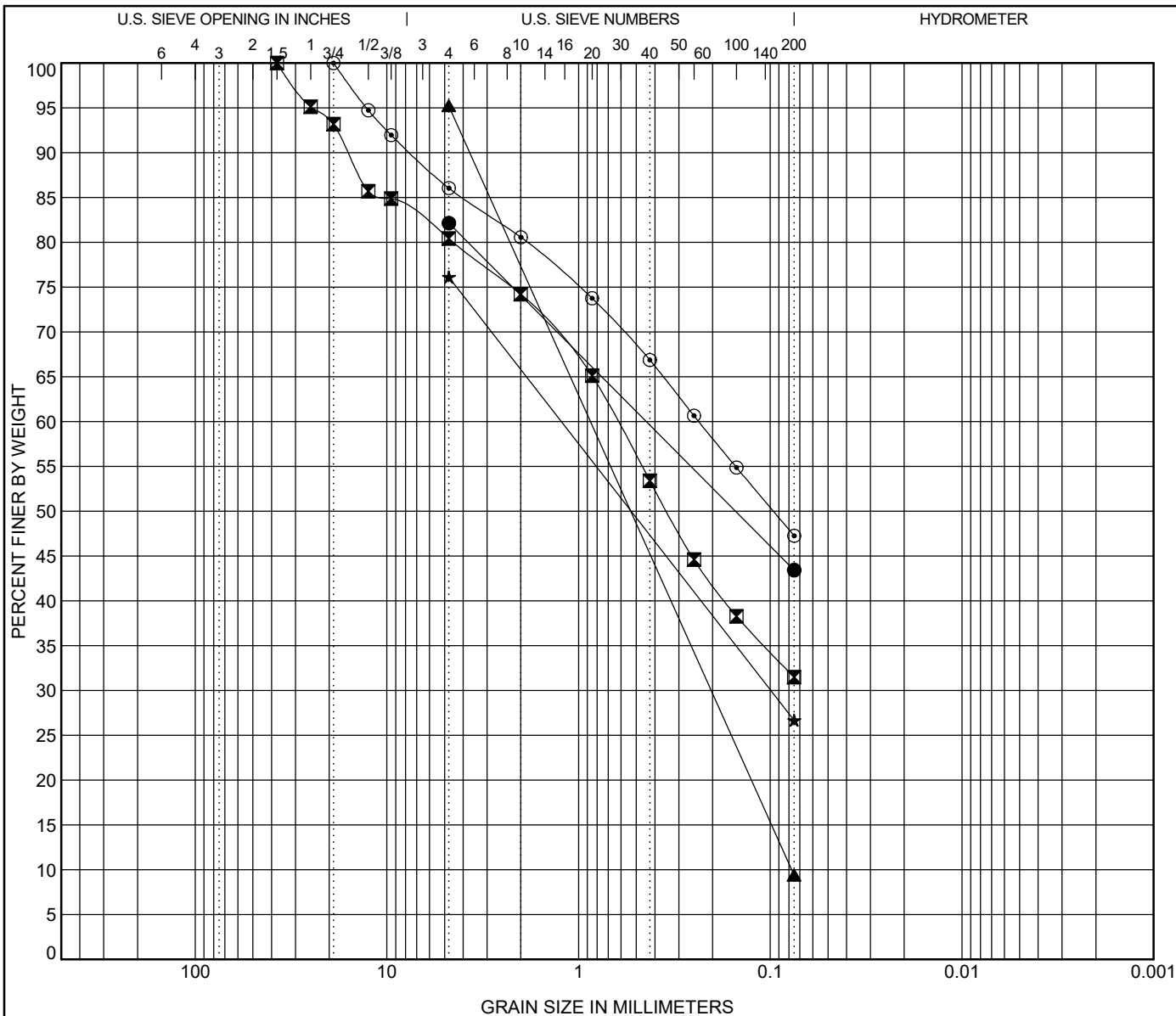
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REMI 1D AND 2D VELOCITY RESULTS

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification				LL	PL	PI	Cc	Cu
●	B-1	4.0	Clayey Sand with Gravel (SC)								
☒	B-2	2.5	Clayey Sand with Gravel (SC)								
▲	B-2	25.0	Well-graded Sand with Clay (SW-SC)							0.62	11.21
★	B-3	0.0	Silty Sand with Gravel (SM)								
◎	B-3	5.0	Clayey Sand (SC)								
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay	
●	B-1	4.0	4.75	0.443			17.9	38.7	43.4		
☒	B-2	2.5	37.5	0.628			19.6	48.9	31.5		
▲	B-2	25.0	4.75	0.866	0.203	0.077	4.8	85.8	9.4		
★	B-3	0.0	4.75	1.228	0.099		23.9	49.4	26.7		
◎	B-3	5.0	19	0.236			14.0	38.8	47.3		



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JOB # 22034.001

APPR: _____

DATE: 5/5/2022

GRAIN SIZE ANALYSIS

GEOTECHNICAL INVESTIGATION
WCSD - BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

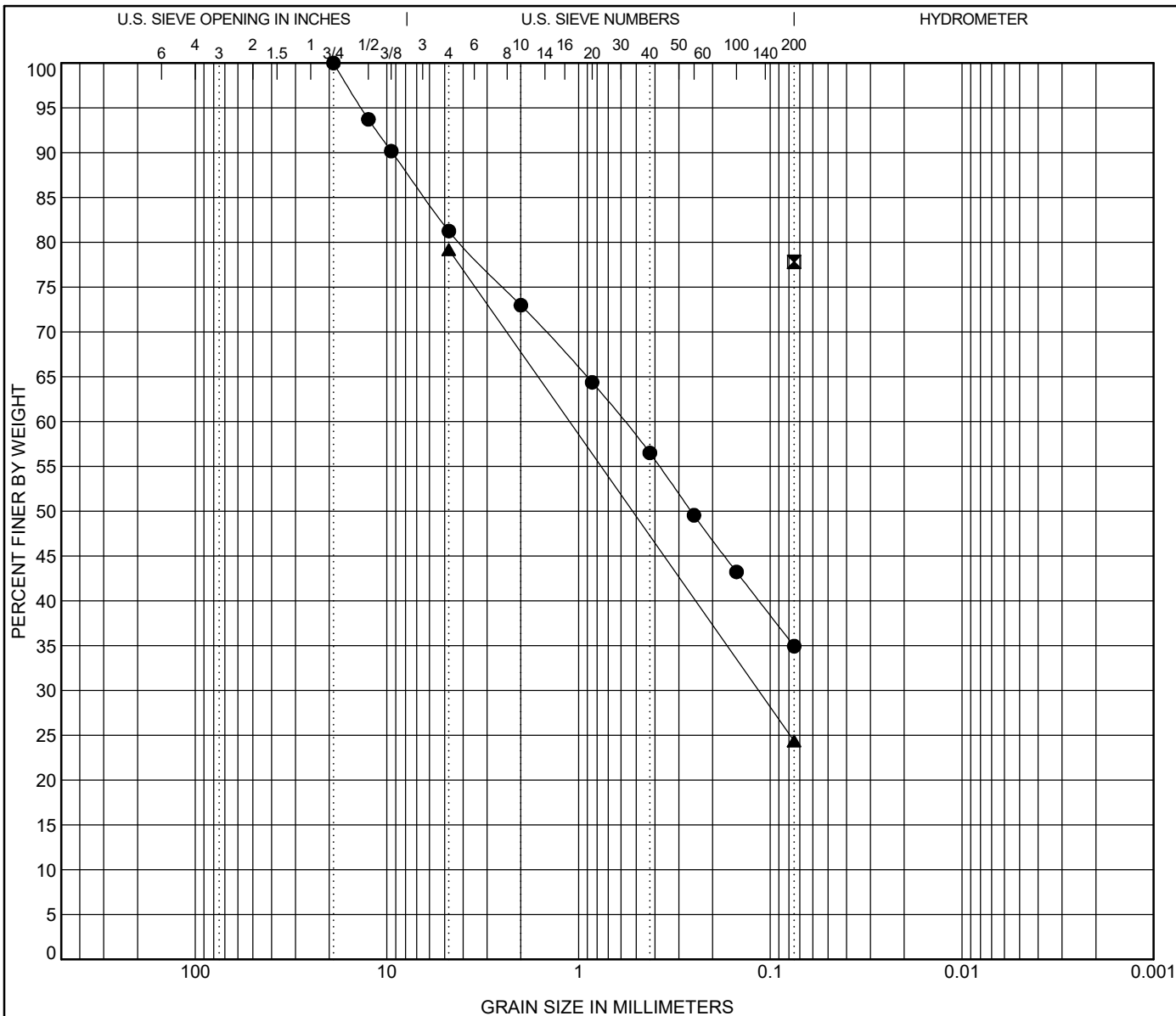
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PLATE

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1 of 2

GRAIN SIZE WASHOE COUNTY BUS FACILITY GPJ MED DATA TEMPLATE 2015A.GDT 5/24/22



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	B-5	2.5	Clayey Sand with Gravel (SC)							
☒	B-5	20.0	Sandy Lean Clay (CL)							
▲	B-6	2.5	Silty Sand with Gravel (SM)							
Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-5	2.5	19	0.578			18.7	46.3	34.9	
☒	B-5	20.0	0.075						77.8	
▲	B-6	2.5	4.75	1.113	0.115		20.8	54.8	24.4	



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APPR: _____

DATE: 5/5/2022

GRAIN SIZE ANALYSIS

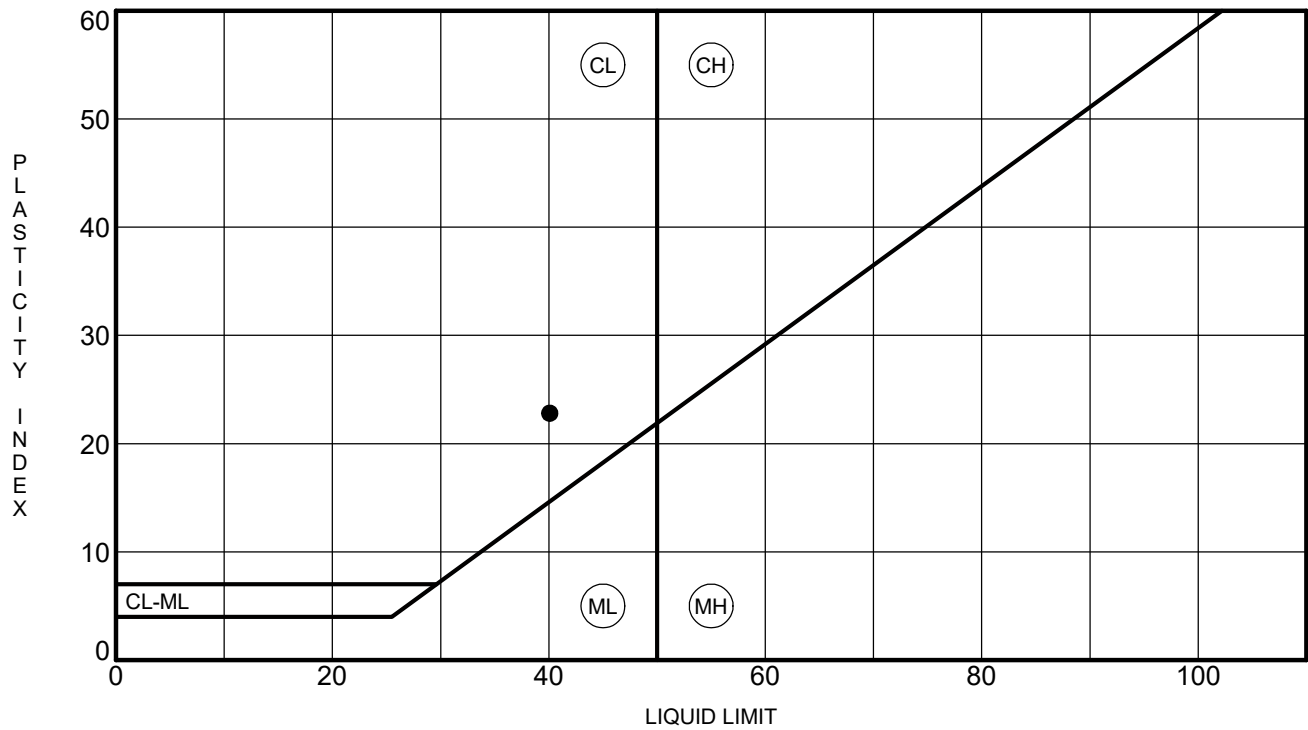
GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

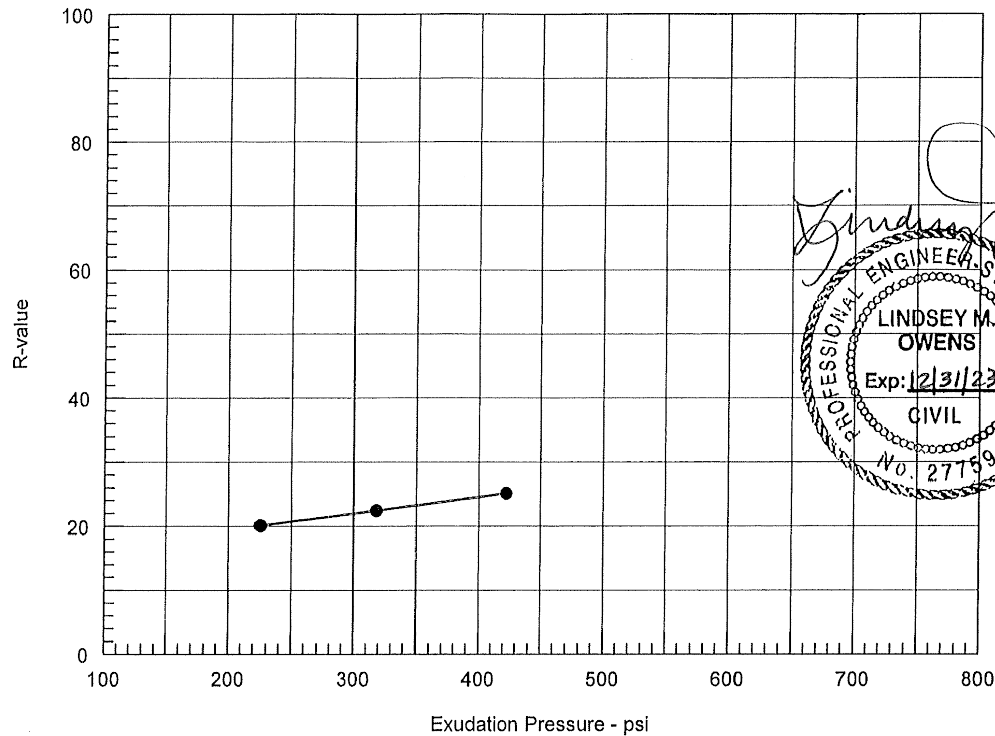
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PLATE

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2 of 2



R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	200	118.0	13.9	0.03	105	2.50	423	25	25
2	150	115.3	15.8	0.00	112	2.53	226	20	20
3	200	118.2	15.1	0.00	109	2.49	318	22	22

Test Results	Material Description
<p>R-value at 300 psi exudation pressure = 22</p>	
<p>Project No.: 2194-01-1 Project: Testing as Ordered Source of Sample: Native / WCSD Sparks Bus Facility Sample Number: Composite B-1, B-4, B-7, B-8 Date: 5/12/2022</p>	<p>Tested by: J. Trainer Checked by: D. Frias Remarks: Laboratory Log 9074</p>
<p>R-VALUE TEST REPORT BLACK EAGLE CONSULTING, INC.</p>	



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R-VALUE RESULTS - COMPOSITE SAMPLE

GEOTECHNICAL INVESTIGATION
 WCSD BUS FACILITY
 1850 KLEPPE LANE - SPARKS

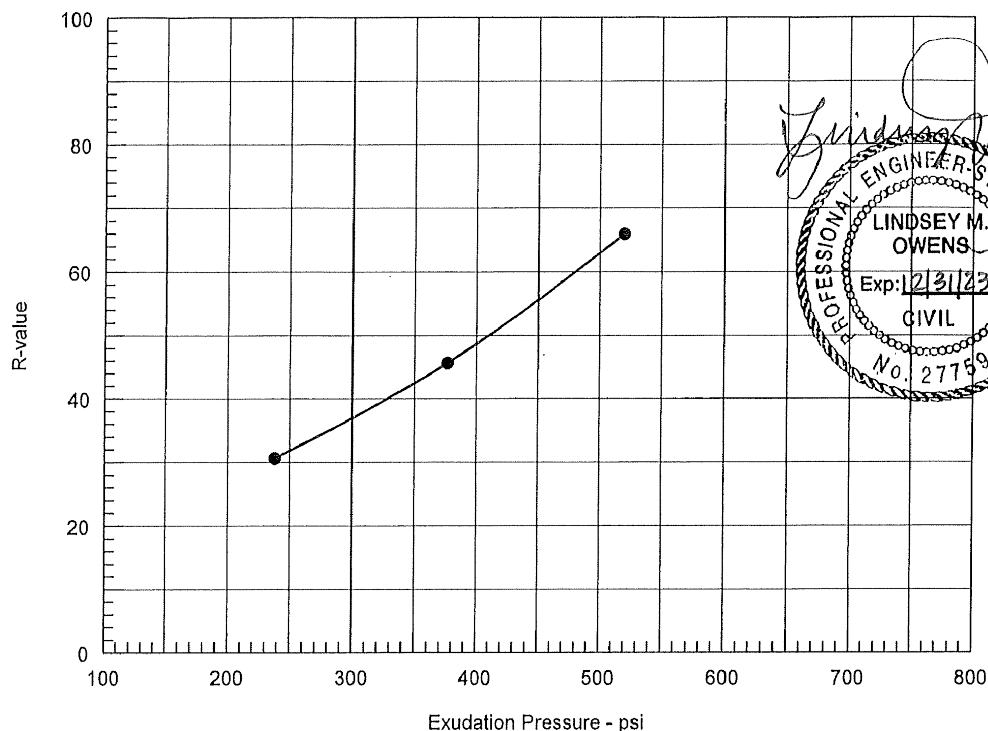
WASHOE COUNTY

NEVADA

PLATE

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R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	250	122.2	12.4	0.00	94	2.51	238	31	31
2	350	122.9	11.6	0.00	69	2.52	376	46	46
3	350	126.3	11.0	0.00	41	2.47	520	66	66

Test Results

R-value at 300 psi exudation pressure = 37

Material Description

Project No.: 2194-01-1
Project: Testing as Ordered
Source of Sample: Native / WCD Sparks Bus Facility **Depth:** 0-5'
Sample Number: B3
Date: 5/12/2022

Tested by: J. Trainer
Checked by: D. Frias
Remarks:
 Laboratory Log 9074

R-VALUE TEST REPORT

BLACK EAGLE CONSULTING, INC.



Reno Tahoe Geo Associates, Inc.

P.O. Box 18449
Reno, Nevada 89511

CONSULTING CIVIL ENGINEERS

TEL (775)853-9100
FAX (775)853-9199

JOB # **22034.001** APPR: **JWP** DATE: **5/16/2022**

R-VALUE RESULTS - B-3

GEOTECHNICAL INVESTIGATION
WCD BUS FACILITY
1850 KLEPPE LANE - SPARKS

WASHOE COUNTY

NEVADA

PLATE

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Reno Tahoe Geo Associates, Inc. - 22040736

Western Environmental Testing Laboratory Analytical Report

Reno Tahoe Geo Associates, Inc.

P.O. Box 18449

Reno, NV 89511

Attn: Elaine Pinnow

Phone: (775) 853-9100 Fax: NoFax

PO\Project: WCSD Sparks Bus Facility/22034.001

Date Printed: 5/11/2022

OrderID: 22040736

Customer Sample ID: B3 @ 2.5 - 4 ft

Collect Date/Time: 4/19/2022 10:00

WETLAB Sample ID: 22040736-001

Receive Date: 4/26/2022 11:10

Analyte	Method	Results	Units	DF	RL	Analyzed	LabID
<u>General Chemistry</u>							
Paste pH	SW846 9045D	7.68	pH Units	1		4/28/2022	NV00925
Resistivity	SM 2510B	650	ohms.cm	1	1.0	4/28/2022	NV00925
<u>Anions by Ion Chromatography</u>							
Chloride	EPA 300.0	13	mg/kg	10	10	4/27/2022	NV00925
Sulfate	EPA 300.0	1600	mg/kg	10	15	4/27/2022	NV00925
<u>Sample Preparation</u>							
10:1 DI Water Extraction	WL 10.0	Complete		1		4/26/2022	NV00925
Saturated Paste Preparation	CSTPM S:1.0	Complete		1		4/28/2022	NV00925

DF=Dilution Factor, RL = Reporting Limit (minimum 3X the MDL), ND = Not Detected <RL or <MDL (if listed)



Reno Tahoe Geo Associates, Inc.

P.O. Box 18449
Reno, Nevada 89511

CONSULTING CIVIL ENGINEERS

TEL (775)853-9100
FAX (775)853-9199

JOB # **22034.001** APPR: **JWP** DATE: **5/16/2022**

CORROSION TEST RESULTS

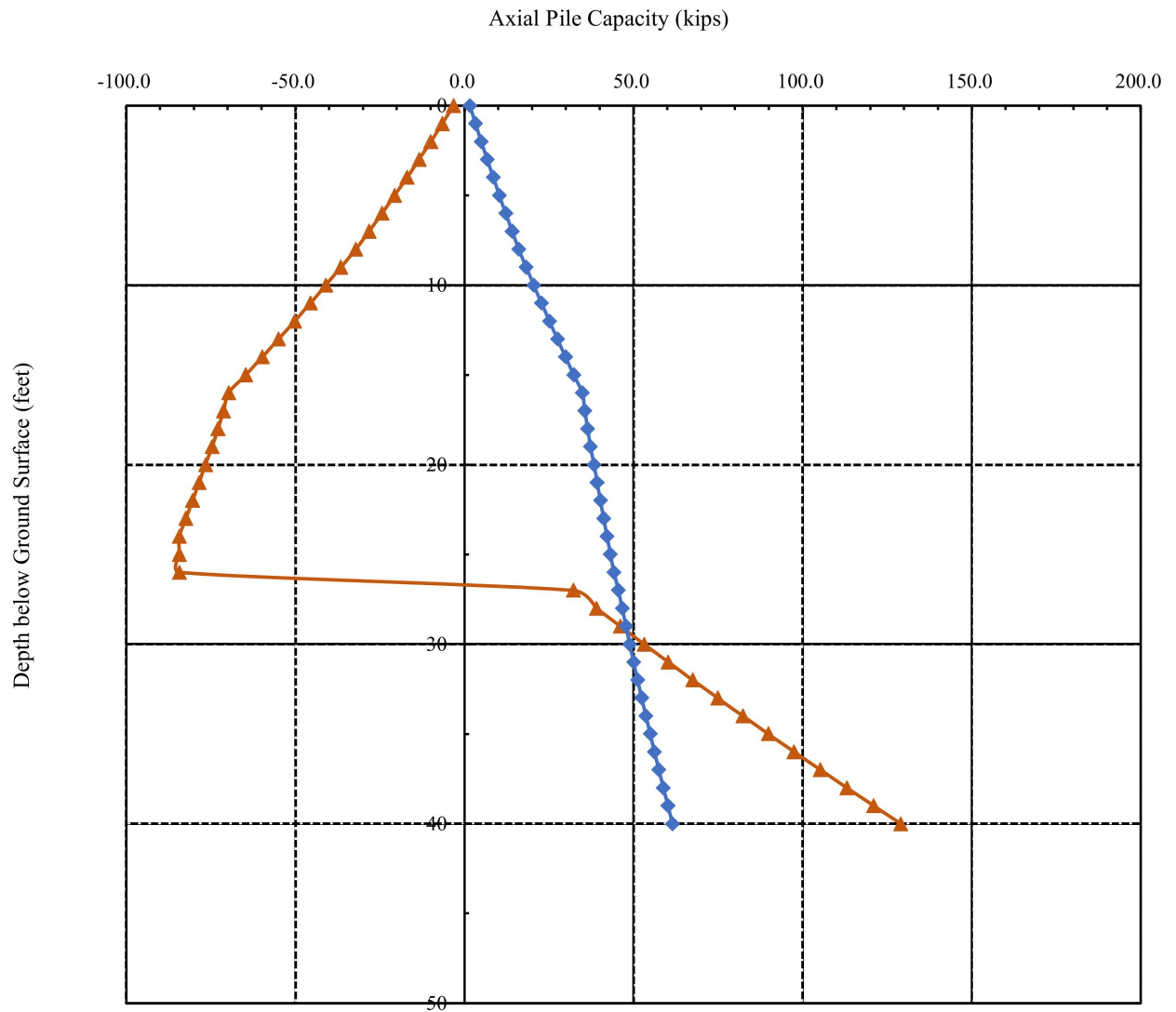
GEOTECHNICAL INVESTIGATION
WCSB BUS FACILITY
1850 KLEPPE LANE - SPARKS

PLATE

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WASHOE COUNTY

NEVADA



P.O. Box 18449
Reno, Nevada 89511

CONSULTING CIVIL ENGINEERS

TEL (775)853-9100
FAX (775)853-9199

JOB # **22034.001**

APPR: **JWP**

DATE: **5/23/2022**

ALLOWABLE PILE CAPACITY VERSUS DEPTH

GEOTECHNICAL INVESTIGATION
WCSD BUS FACILITY
1850 KLEPPE LANE – SPARKS

WASHOE COUNTY

NEVADA

PLATE

18

APPENDIX A

Boring ID:

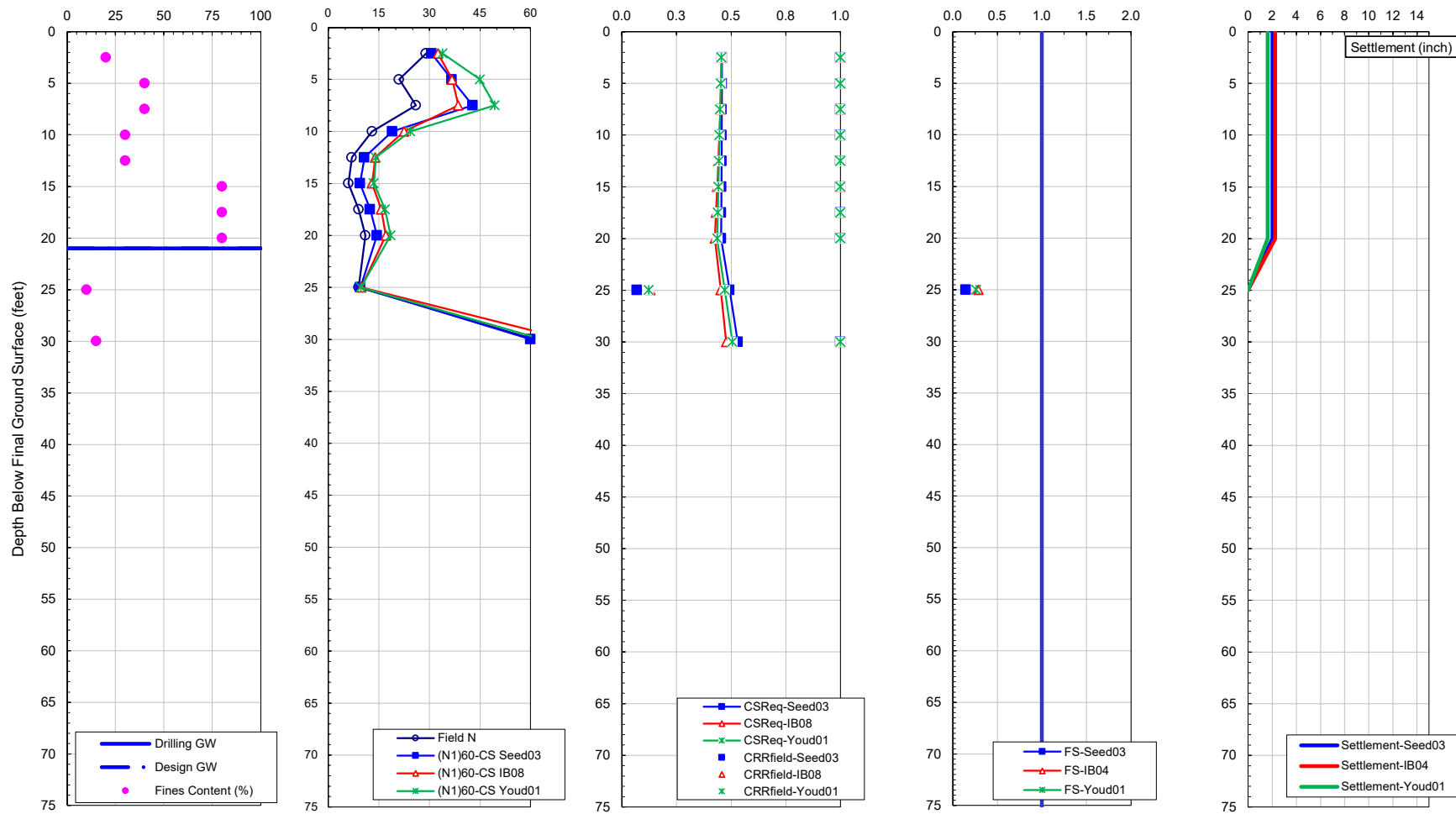
B-2

$M_w = 7.0$
PGA = 0.70g

Groundwater Depth During Drilling (ft) = 21.0 ft
Design Groundwater Depth (ft) = 21.0 ft

Existing Ground Elevation = 4390.0 ft
Final Ground Elevation = 4390.0 ft

Ana. by: Prem Arun
Checked by: Jon Pease



1. $(N_1)_{60-CS}$ capped at 60; 2. CRRfield = 1 for non-liquefiable soils; 3. FS is capped at 2.0 for liquefiable soils and not plotted for non-liquefiable soils including soils above G.W.T.



Project Name: WCSD Sparks Bus Facility
Project No.: 22034.001
Project Location: Sparks, NV

LIQUEFACTION ANALYSIS

Date: 5/14/2022

FIGURE A-1

Boring
ID:

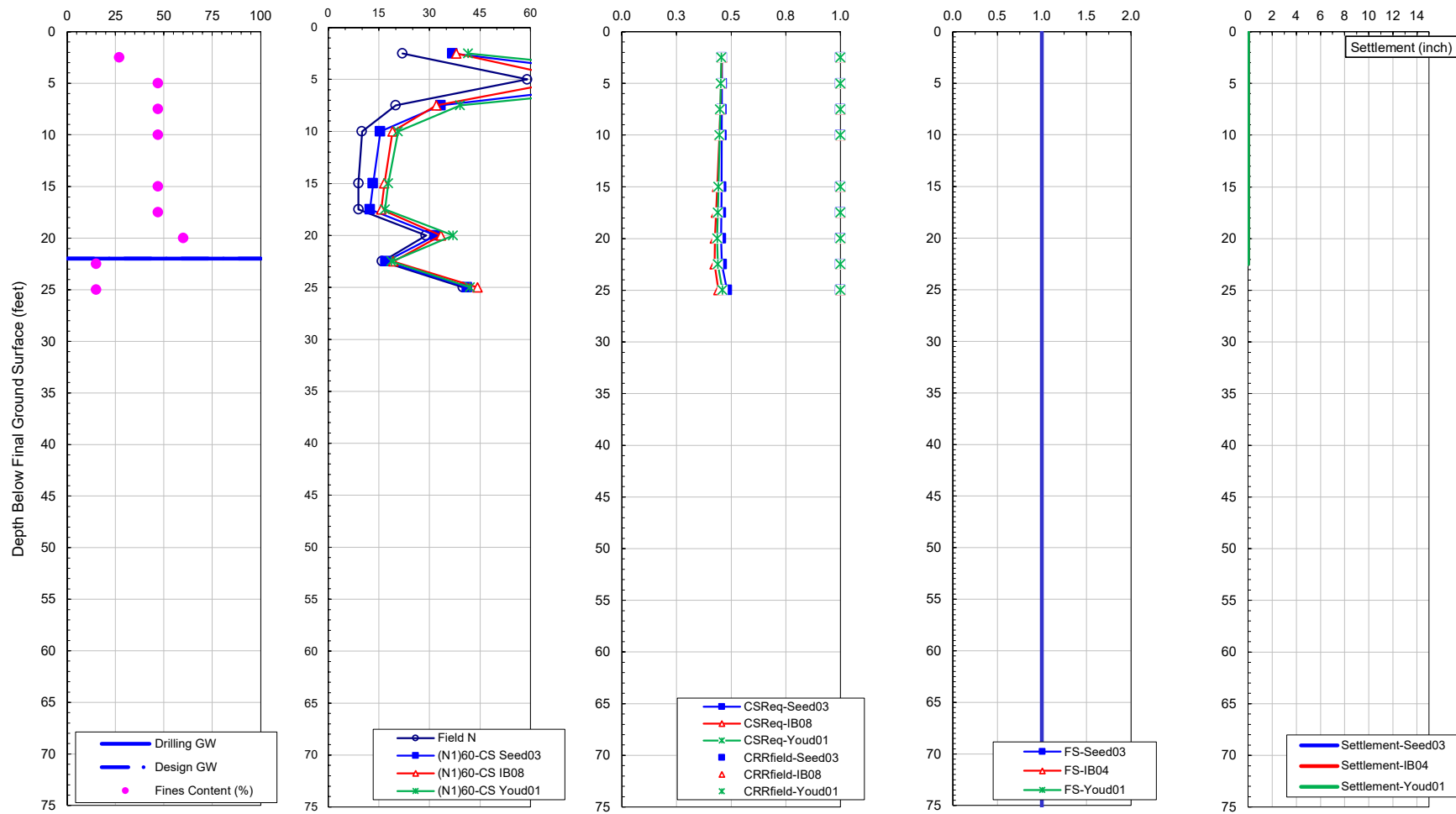
B-3

$M_w = 7.0$
 $PGA = 0.70g$

Groundwater Depth During Drilling (ft) = **22.0 ft**
Design Groundwater Depth (ft) = **22.0 ft**

Existing Ground Elevation = **4390.0 ft**
Final Ground Elevation = **4390.0 ft**

Ana. by: Prem Arun
Checked by: Jon Pease



1. $(N_1)_{60-CS}$ capped at 60; 2. $CRR_{field} = 1$ for non-liquefiable soils; 3. FS is capped at 2.0 for liquefiable soils and not plotted for non-liquefiable soils including soils above G.W.T.


Reno Tahoe Geo Associates, Inc.

Project Name: **WCSD Sparks Bus Facility**
Project No.: **22034.001**
Project Location: **Sparks, NV**

LIQUEFACTION ANALYSIS

Date: **5/20/2022**

FIGURE A-2

Boring
ID:

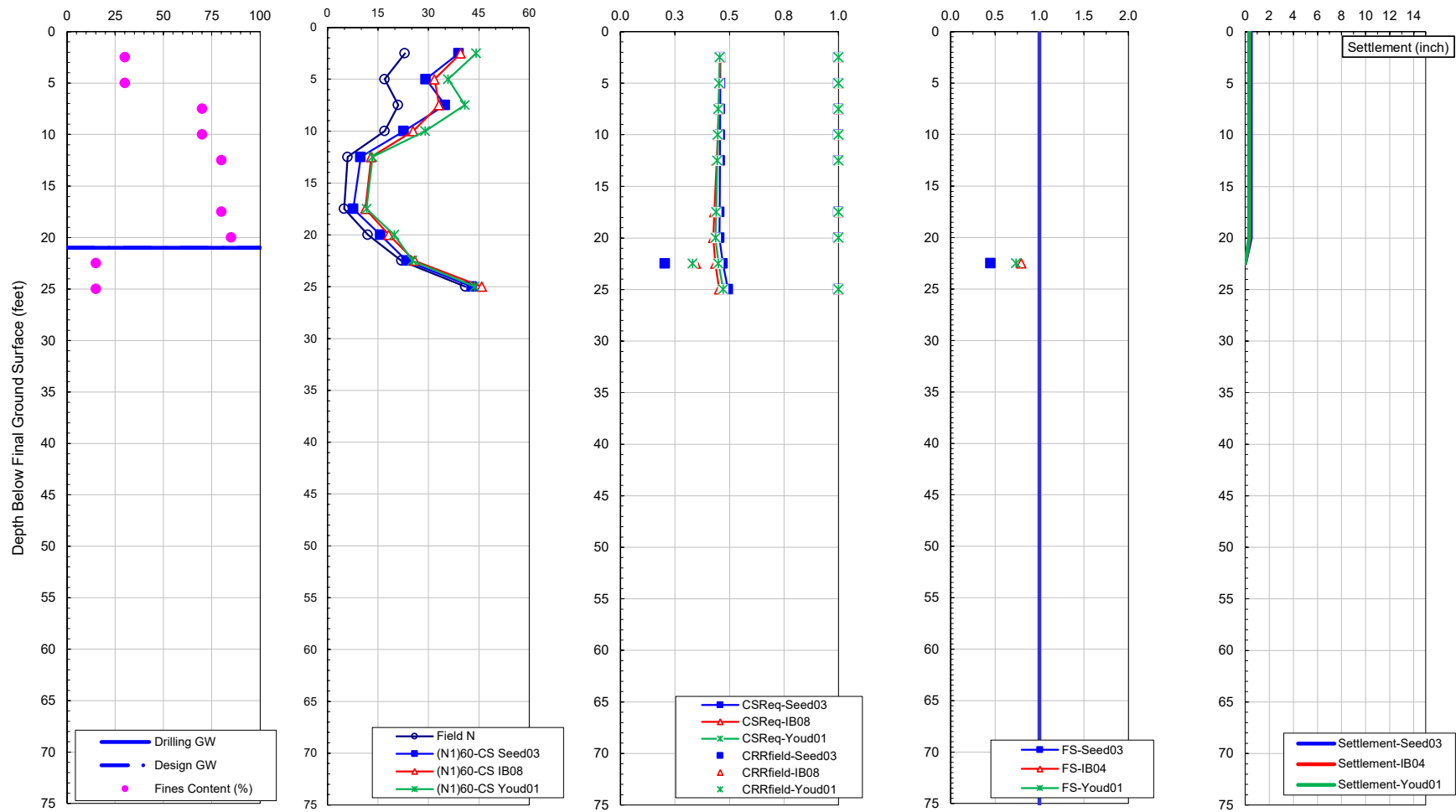
B-5

$M_w = 7.0$
PGA = 0.70g

Groundwater Depth During Drilling (ft) = 21.0 ft
Design Groundwater Depth (ft) = 21.0 ft

Existing Ground Elevation = 4390.0 ft
Final Ground Elevation = 4390.0 ft

Ana. by: Prem Arun
Checked by: Jon Pease



1. $(N_1)_{60-CS}$ capped at 60; 2. CRRfield = 1 for non-liquefiable soils; 3. FS is capped at 2.0 for liquefiable soils and not plotted for non-liquefiable soils including soils above G.W.T.



Project Name: WCD Sparks Bus Facility
Project No.: 22034.001
Project Location: Sparks, NV

LIQUEFACTION ANALYSIS

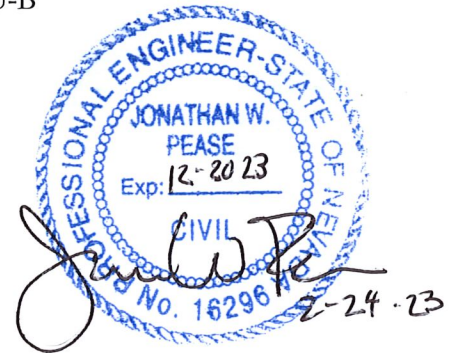
Date 5/14/2022

FIGURE A-3

Consulting Civil Engineers
P.O. Box 18449
Reno, Nevada 89511
TEL (775) 853-9100

Memorandum

To: Kevin Merkling, WCSD, Rachel Cave, Lonnie Johnson, J-U-B
From: Pablo F. Becerra and Jonathan W. Pease, RTGA *P.B.*
Date: February 24, 2023
Project No.: 22034.002
Subject: Supplemental Pavement Recommendations



This memorandum presents assumptions and recommendations for Asphalt Concrete (AC) and Portland Cement Concrete (PCC) pavement design recommendations for Washoe County School District Bus Yard. This memorandum more closely considers traffic patterns and distributions based on better-developed project maps and plans than we initially had available in our geotechnical report dated May 23, 2022. Pavement sections were developed using the 1993 AASHTO method for the design of flexible and rigid pavements. The method uses, as its basis, the total traffic in Equivalent 18-thousand-pound Single Axle Loads (ESALs) expected for the project over a specific pavement life and the soil subgrade strength using the resilient modulus.

This memorandum provides pavement sections for major differing roadway areas in different phases of the project. The information included to us from J-U-B and the client helped provide calculations needed for the new bus facility. Additional information was provided to RTGA with accurate daily traffic, vehicle type, parking spaces and more to help design the appropriate Phase ESAL for the project. The design was based on full capacity of the facility; therefore, no annual growth or period growth rate was added.

The north and east vehicle parking lot holds roughly 210 vehicles, which we assume will have two (2) trips per day (1-in, 1-out) per vehicle. This is not a major consideration since cars and trucks do not have significant ESALs. The bus parking lot has 220 spaces, some of which may include excessive or inactive vehicles. Each bus will have four (4) trips per day (2-in, 2-out) across the most heavily loaded roadways.

Phase 1B is the parking area along the north and west boundaries of the project, which is eventually assumed to be primarily for employee and driver vehicle parking. During the first year, there may be a wide mix of vehicles due to construction traffic in other areas.

Memo: WCSD Bus Facility Pavement Recs

February 24, 2023

Page 2 of 6

TABLE 1A - PHASE 1B REAR PARKING - YEAR 1 - ESTIMATED TRAFFIC VOLUMES		
Type	Percent of vehicles	Vehicle Trips/day
Cars	50	210
4 tire truck	25	105
Van busses- 2 axle 6 tire	25	105
12-ton School Busses	100	1,024

TABLE 1B – PHASE 1B REAR PARKING - YEAR 2 - 20 ESTIMATED TRAFFIC VOLUMES		
Type	Percent of vehicles	Vehicle Trips/day
Cars	50	210
4 tire truck	25	105
Van busses- 2 axle 6 tire	25	105
12-ton School Busses	0	0
ESAL Loading (20 year)	1.67 x 10 ⁵	

For comparison, we looked at the values provided using the results of the J-U-B Traffic Study, and found them similar and only slightly lower:

TABLE 2A- PHASE 1B REAR PARKING - PART B YEAR 1 - ESTIMATED TRAFFIC VOLUMES (CHECK)		
Type	Percent of vehicles	Vehicle Trips/day
Cars	50	440
4 tire truck	25	220
Van busses- 2 axle 6 tire	25	220
12-ton School Busses	100	880

Memo: WCSD Bus Facility Pavement Recs

February 24, 2023

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TABLE 2B - PHASE 1B REAR PARKING - PART B YEAR 2-20 - ESTIMATED TRAFFIC VOLUMES (CHECK)		
Type	Percent of vehicles	Vehicle Trips/day
Cars	50	440
4 tire truck	25	220
Van busses- 2 axle 6 tire	25	220
12-ton School Busses	0	0
ESAL Loading (20 year)	1.50 x 10 ⁵	

The small parking lot by the maintenance facility has no access for bus parking and is limited to about 50 spaces.

TABLE 3 – PHASE 1B SMALL PARKING LOT - ESTIMATED TRAFFIC VOLUMES		
Type	Percent of vehicles	Vehicle Trips/day
Cars	50	40
4 tire truck	40	32
Van busses- 2 axle 6 tire	10	8
12-ton School Busses	0	0
ESAL Loading (20 year)	<10,000	

Memo: WCSD Bus Facility Pavement Recs

February 24, 2023

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Washing and fueling areas are assumed to be visited by each bus at most once every four days.

TABLE 4- PHASE 1 D FUELING AND WASHING AREAS - ESTIMATED TRAFFIC VOLUMES		
Type	Percent of vehicles	Vehicle Trips/day
Cars	0	0
4 tire truck	0	0
Van busses- 2 axle 6 tire	0	0
12-ton School Busses	25	55
ESAL Loading (20 year)	1.22 x 10 ⁵	

The main driveway around the north and east side of the facility is assumed to have vehicles from area 1B and a smaller number of school busses and delivery trucks.

TABLE 5- PHASE 1D AND 1E NORTH AND EAST DRIVEWAY - ESTIMATED TRAFFIC VOLUMES		
Type	Percent of vehicles	Vehicle Trips/day
Cars	79	348
4 tire truck	20	88
10-wheeler Truck Deliveries	1	4
12-ton School Busses	10	44
ESAL Loading (20 year)	1.14 x 10 ⁵	

Memo: WCSB Bus Facility Pavement Recs

February 24, 2023

Page 5 of 6

Table 6 Assumes that buses use the bus maintenance facility once every 10 days on average, one way traffic.

TABLE 6- PHASE 2 BUS MAINTENANCE LANES - ESTIMATED TRAFFIC VOLUMES		
Type	Percent of vehicles	Vehicle Trips/day
Cars	0	0
4 tire truck	0	0
Van busses- 2 axle 6 tire	0	0
12-ton School Busses	10	22
ESAL Loading (20 year)	6.1 x 10 ⁴	

TABLE 7- PHASE 3 MAIN BUS PARKING LOT - ESTIMATED TRAFFIC VOLUMES (INCLUDING ENTRANCES FROM STREET)		
Type	Percent of vehicles	Vehicle Trips/day
Cars	10	88
4 tire truck	20	176
Van busses- 2 axle 6 tire	20	176
12-ton School Busses	100	880
ESAL Loading (20 year)	2.48 x 10 ⁶	

Two R-value test results of 37 and 22 were measured for near-surface soils on the site. The R-value of 22 that was measured for the soils near Kleppe Lane Drive was the more conservative value of the two and was used for design. Drainage conditions were assumed to be fair (subgrade saturated 25 percent or more of the time) based on shallow groundwater levels in the area.

If there are clay soils within 2 feet of the bottom of AC or PCC layers, they should be overexcavated 2 feet and replaced with structural fill, as described in the geotechnical report. The thickness of the aggregate base may be included in the necessary separation thickness.

Memo: WCSB Bus Facility Pavement Recs

February 24, 2023

Page 6 of 6

We recommend for the AC pavement design that the pavement course thicknesses correspond to those on the tables below. In our experience, pavement sections are most economical when the AC thickness is about half of the AB thickness (e.g., 5 inches AC on 10 inches AB). PCC pavements were only requested for the maintenance and loading dock areas around the maintenance facility.

TABLE 7 - PAVEMENT COURSE THICKNESS RECOMMENDATIONS			
Asphalt Pavement Design Section	AC (inches)	Pavement (PCC-inches)	AB (or RAB) (inches)
Phase 1B Driver Parking AC	5	--	8
Phase 1B Small Parking Lot	3	--	6
Phase 1D & 1E Fuel Wash, Phase 2 Maintenance AC	5	--	8
Phase 1D & 1E Fuel Wash, Phase 2 Maintenance PCC	--	8	6
Phase 1D and 1E North and East Driveway AC	5		8
Phase 1D and 1E North and East Driveway AC	--	8	6
Phase 3 Bus Yard AC	7	--	12
Phase 3 Bus Yard PCC	--	12	6

Pavement performance can be greatly affected by saturation of unbound layers and subgrade soils. Based on our experience in Northern Nevada, environmental aspects, such as freeze-thaw cycles and thermal cracking will probably govern the life of AC pavements. Thermal cracking of the asphalt pavement allows more water to enter the pavement section, which promotes deterioration and increases maintenance costs.

Plate

Plate 1 Map of Phase Locations of Different Pavements

Attachments:

Page 1 – 7 Pavement Design Calculations for AC Pavements

Page 8 – 11 Pavement Design Calculations for CTB Pavements

END MEMO

ATTACHMENTS

PROJECT PHASE/Area

18 kip ESAL CALCULATION WORKSHEET

PROJECT NO.:	22034.002	DATE:	2/21/2022
PROJECT NAME:	WCSD BUS FACILITY	PREPARED BY:	JWP
PROJECT ADDRESS:	KLEPPE LANE	CHECKED BY:	JWP
PROJECT CITY:	SPARKS, NV		
PROJECT PHASE/AREA	Phase IB - Staff Parking		
DESIGN CONDITION:	20 YR FOR AC PAVEMENT		

INPUT PARAMETERS

FIRST ONE YEARS:	Area may be striped or used somewhat more intensively for mixed traffic							
	Trips/Wkday					Daily traffic per		
Parking Spaces	/Space	Trips/Year	Vehicle	% of traffic		type	ESAL/vehicle	EASLs/yr
210	2	105,000	Cars	50	210	0.00002	1.05	
			4 tire trucks	25	105	0.0006	15.75	
			Van busses - 2 axle 6 tire	25	105	0.049	1,286.25	
	School buses are included in first year							
	2	256000	12-ton School Busses	100	1,024	0.553	141,568.00	
						Yearly Sum:	142871.05	

FOLLOWING 19 YEARS Area not really bus accessible, only small parking spaces

	Trips/Day/Sp							
Parking Spaces	ace	Trips/Year	Vehicle	% of traffic		ESAL/vehicle	EASLs/yr	
210	2	105,000	Cars	50	210	0.00002	1.05	
			4 tire trucks	25	105	0.0006	15.75	
			Van busses - 2 axle 6 tire	25	105	0.049	1,286.25	
			12-ton School Busses	0	-	0.553	-	
						Yearly Sum:	1303.05	

For 20 years

167,629.00

Total 20 Year Traffic Volume ESALs	167,629.00	ESAL/20 year
PERCENT TRUCKS IN DESIGN LANE, T _l	100	%
PERCENT TRUCKS IN DESIGN DIRECTION, T _d	100	%

DESIGN IS BASED ON CAPACITY OF FACILITY, THEREFORE NO ANNUAL GROWTH OR PERIOD GROWTH RATE

OUTPUT PARAMETERS

$$ESAL = ESAL_{20} \times \text{design lane} \times \text{design direction}$$

DESIGN ESAL_{18 kip}	1.68E+05
-------------------------------------	-----------------

<u>Number of Lanes</u>	<u>AASHTO</u>
2 lanes (1 per direction)	100%
4 lanes (2 per direction)	80-100%
6+ lanes (3+ per direction)	50-80%

PROJECT PHASE/Area

18 kip ESAL CALCULATION WORKSHEET

PROJECT NO.:	22034.002	DATE:	2/21/2022
PROJECT NAME:	WCSD BUS FACILITY	PREPARED BY:	JWP
PROJECT ADDRESS:	KLEPPE LANE	CHECKED BY:	JWP
PROJECT CITY:	SPARKS, NV		
PROJECT PHASE/AREA	Phase IB - Staff Parking Alternate Assumptions from JUB Traffic Study		
DESIGN CONDITION:	20 YR FOR AC PAVEMENT		

INPUT PARAMETERS

FIRST ONE YEARS:		Area may be striped or used somewhat more intensively for mixed traffic					
					Daily traffic per		
Parking Spaces	Trips/Wkday	Trips/Year	Vehicle	% of traffic type	ESAL/vehicle	EASLs/yr	
220	4	220,000	Cars	50	440	0.00002	2.20
			4 tire trucks	25	220	0.0006	33.00
			Van busses - 2 axle 6 ti	25	220	0.049	2,695.00
School buses are included in first year					880		
	2	220,000	12-ton School Busses	100	880	0.553	121,660.00
Yearly Sum:							124390.2

FOLLOWING 19 YEARS		Area not really bus accessible, only small parking spaces					
Parking Spaces	Trips/Day/Space	Trips/Year	Vehicle	% of traffic	ESAL/vehicle	EASLs/yr	
220	2	110,000	Cars	50	440	0.00002	1.10
			4 tire trucks	25	220	0.0006	16.50
			Van busses - 2 axle 6 ti	25	220	0.049	1,347.50
			12-ton School Busses	0	-	0.553	-
Yearly Sum:							1365.1

		For 20 years		150,327.10	ESAL/20 year
Total 20 Year Traffic Volume ESALs				150,327.10	ESAL/20 year
PERCENT TRUCKS IN DESIGN LANE, T _l		Assumes aisle used both ways		100	%
PERCENT TRUCKS IN DESIGN DIRECTION, T _d				100	%

DESIGN IS BASED ON CAPACITY OF FACILITY, THEREFORE NO ANNUAL GROWTH OR PERIOD GROWTH RATE

OUTPUT PARAMETERS

$$ESAL = ESAL_{20} \times \text{design lane} \times \text{design direction}$$

DESIGN ESAL_{18 kip}		1.50E+05
-------------------------------------	--	----------

Number of Lanes	AASHTO
2 lanes (1 per direction)	100%
4 lanes (2 per direction)	80-100%
6+ lanes (3+ per direction)	50-80%

PROJECT PHASE/Area

18 kip ESAL CALCULATION WORKSHEET

PROJECT NO.:	22034.002	DATE:	2/21/2022
PROJECT NAME:	WCSD BUS FACILITY	PREPARED BY:	JWP
PROJECT ADDRESS:	KLEPPE LANE	CHECKED BY:	JWP
PROJECT CITY:	SPARKS, NV		
PROJECT PHASE/AREA	Phase ID - Fueling and Washing 5 lanes 3 Bus Parking		
DESIGN CONDITION:	20 YR FOR AC PAVEMENT		

INPUT PARAMETERS

20 YEARS Assume each bus of the fleet uses it every 4th day. Multiply by 80% to address loads in merging areas

Parking Spaces	Trips/Day/Sp	Trips/Day	Trips/Year	Vehicle	% of traffic	Daily traffic per type	ESAL/vehicle	EASLs/yr
220	0.25	55	13,750	Cars	0	-	0.00002	-
				4 tire trucks	0	-	0.0006	-
				Van busses - 2 axle 6 tire	0	-	0.049	-
				12-ton School Busses	100	55	0.553	7,603.75
						Sum:		7603.75
			For 20 years					152,075.00

Total 20 Year Traffic Volume ESALs 152,075.00 ESAL/20 year

PERCENT TRUCKS IN DESIGN LANE, T _l	Assumes aisle used both ways	80	%
PERCENT TRUCKS IN DESIGN DIRECTION, T _d		100	%

DESIGN IS BASED ON CAPACITY OF FACILITY, THEREFORE NO ANNUAL GROWTH OR PERIOD GROWTH RATE

OUTPUT PARAMETERS

ESAL= ESAL 20 x design lane x design direction

DESIGN ESAL_{18 kip}		1.22E+05
-------------------------------------	--	-----------------

Number of Lanes		AASHTO
2 lanes (1 per direction)		100%
4 lanes (2 per direction)		80-100%
6+ lanes (3+ per direction)		50-80%

PROJECT PHASE/Area

18 kip ESAL CALCULATION WORKSHEET

PROJECT NO.:	22034.002	DATE:	2/21/2022
PROJECT NAME:	WCSD BUS FACILITY	PREPARED BY:	JWP
PROJECT ADDRESS:	KLEPPE LANE	CHECKED BY:	JWP
PROJECT CITY:	SPARKS, NV		
PROJECT PHASE/AREA	Phase ID and 1E - South and North Driveways, also driveway along east side of Phase 2		
DESIGN CONDITION:	20 YR FOR AC PAVEMENT		

INPUT PARAMETERS

20 YEARS Assume each bus of the fleet uses it every day. Each is one way, no two-way traffic

Parking Spaces	Trips/Day/Sp	Trips/Year	Vehicle	% of traffic	Daily traffic per type	ESAL/vehicle	EASLs/yr
220	2	110,000	Cars	79	348	0.00002	1.74
			4 tire trucks	20	88	0.0006	13.20
Two semis per day		1100	Truck Deliveries	1	4	2.39	2,629.00
			12-ton School Busses	5	22	0.553	3,041.50
			Sum:				5685.438
		For 20 years					113,708.76

Total 20 Year Traffic Volume ESALs	113,708.76	ESAL/20 year
PERCENT TRUCKS IN DESIGN LANE, T_l	Assumes aisle used both ways	100 %
PERCENT TRUCKS IN DESIGN DIRECTION, T_d		100 %

DESIGN IS BASED ON CAPACITY OF FACILITY, THEREFORE NO ANNUAL GROWTH OR PERIOD GROWTH RATE

OUTPUT PARAMETERS

ESAL = ESAL 20 x design lane x design direction

DESIGN ESAL_{18 kip}	1.14E+05
-------------------------------------	-----------------

Number of Lanes	AASHTO
2 lanes (1 per direction)	100%
4 lanes (2 per direction)	80-100%
6+ lanes (3+ per direction)	50-80%

18 kip ESAL CALCULATION WORKSHEET

PROJECT NO.:	22034.002	DATE:	2/21/2022
PROJECT NAME:	WCSD BUS FACILITY	PREPARED BY:	JWP
PROJECT ADDRESS:	KLEPPE LANE	CHECKED BY:	JWP
PROJECT CITY:	SPARKS, NV		
PROJECT PHASE/AREA	Phase 2 BUS MAINTENANCE LANES		
DESIGN CONDITION:	20 YR FOR AC PAVEMENT		

INPUT PARAMETERS

20 YEARS Assume each bus of the fleet uses it every 10th day. Use 1/10 of all busses

Parking Spaces	Trips/Day/Space	Trips/Year	Vehicle	% of traffic	Daily traffic per type	ESAL/vehicle	EASLs/yr
220	0.1	5,500	Cars		0	-	0.00002
			4 tire trucks		0	-	0.0006
			Van busses - 2 axle 6 tire		0	-	0.049
			12-ton School Busses	100	22	0.553	3,041.50
						Sum:	3041.5
							60,830.00

For 20 years

Total 20 Year Traffic Volume ESALs	60,830.00	ESAL/20 year
PERCENT TRUCKS IN DESIGN LANE, T _l	Assumes aisle used both ways	80 %
PERCENT TRUCKS IN DESIGN DIRECTION, T _d		100 %

DESIGN IS BASED ON CAPACITY OF FACILITY, THEREFORE NO ANNUAL GROWTH OR PERIOD GROWTH RATE

OUTPUT PARAMETERS

$$ESAL = ESAL_{20} \times design\ lane \times design\ direction$$

DESIGN ESAL_{18 kip}	4.87E+04
-------------------------------------	-----------------

<u>Number of Lanes</u>	<u>AASHTO</u>
2 lanes (1 per direction)	100%
4 lanes (2 per direction)	80-100%
6+ lanes (3+ per direction)	50-80%

18 kip ESAL CALCULATION WORKSHEET

PROJECT NO.:	22034.002	DATE:	2/21/2022
PROJECT NAME:	WCSD BUS FACILITY	PREPARED BY:	JWP
PROJECT ADDRESS:	KLEPPE LANE	CHECKED BY:	JWP
PROJECT CITY:	SPARKS, NV		
PROJECT PHASE/AREA	Phase 3 MAIN BUS PARKING LOT		
DESIGN CONDITION:	20 YR FOR AC PAVEMENT		

<u>INPUT PARAMETERS</u>		Busses will be in and out on same road for the morning and afternoon trips					
20 YEARS		Note that only the inlet beside the fueling facility has one route, the rest have multiple exits out.					
	Trips/Day/Space				Daily traffic per		
Parking Spaces		Trips/Year	Vehicle	% of traffic	type	ESAL/vehicle	EASLs/yr
220	4	220,000	Cars	10	88	0.00002	0.44
			4 tire trucks	20	176	0.0006	26.40
			Van busses - 2 axle 6 tire	20	176	0.049	2,156.00
			12-ton School Busses	100	880	0.553	121,660.00
					Sum:		123842.84
		For 20 years					2,476,856.80
Total 20 Year Traffic Volume ESALS						2,476,856.80	ESAL/20 year
PERCENT TRUCKS IN DESIGN LANE, T _l			Assumes aisle used both ways			100	%
PERCENT TRUCKS IN DESIGN DIRECTION, T _d						100	%
DESIGN IS BASED ON CAPACITY OF FACILITY, THEREFORE NO ANNUAL GROWTH OR PERIOD GROWTH RATE							
<u>OUTPUT PARAMETERS</u>							

$$ESAL = ESAL_{20} \times \text{design lane} \times \text{design direction}$$

DESIGN ESAL_{18 kip}		2.48E+06
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Number of Lanes	AASHTO
2 lanes (1 per direction)	100%
4 lanes (2 per direction)	80-100%
6+ lanes (3+ per direction)	50-80%

WCSD is a 12-ton school bus

School Bus Loads	Load in Kips		ESALS per Asphalt Institute 1991 table IV-4		ESALS per vehicle
	Front Axle	Rear Axle	Front	Rear	
	9	15	0.061	0.4915	0.5525
All are single axles					

Phase 1B Driver Parking Areas

Pavement Design
(AASHTO 1993 Method)

Design Inputs

Sugrade Support

Asphalt

Concrete

Reliability

Standard Deviation

Initial Serviceability

Terminal Serviceability

Design Serviceability Loss,

CBR = 7.02

Mr = 8890 psi
%

So = 0.45

Po = 4.2

Pt = 2.0

Δ PSI = 2.2

k = 168 pci
%

0.35

4.5

2.5

2.0

Layer Coefficients:

AC Surface and Binder $a_1 = 0.35$

Aggregate Base $a_2 = 0.10$

Concrete Compressive Strength = 4000 psi
Modulus of Elasticity of Concrete = 3,600 ksi
Modulus of Rupture of Concrete: = 580
Load Transfer ("J" Factor) = 4.2
Drainage Coefficient = 0.7

Asphalt Section Traffic (18 kip ESAL) =

Minor Arterial
167,000

Asphalt Pavement Section

Drainage, m

AC Surface + Binder

4.6 in.

Aggregate Base

1.0

8.0 in.

Structural Number: 2.41

Structural Number - Required 2.38

Concrete Section Traffic (18 kip ESAL) =

Minor Arterial
167,000

Concrete Pavement Section

7.7 in.

Project: Washoe County Bus Facility

Location: Sparks NV

Project No. 22034.002

Date: 02/08/22

Pavement Design

(AASHTO 1993 Method)

Design Inputs

Sugrade Support

Asphalt

CBR = 7.02

Mr = 8890 psi
90 %

So = 0.45

Po = 4.2

Pt = 2.0

Δ PSI = 2.2

Concrete

k = 168 pci
90 %

0.35

4.5

2.5

2.0

Layer Coefficients:

AC Surface and Binder $a_1 = 0.35$

Aggregate Base $a_2 = 0.10$

Concrete Compressive Strength = 4000 psi
Modulus of Elasticity of Concrete = 3,600 ksi
Modulus of Rupture of Concrete: = 580
Load Transfer ("J" Factor) = 4.2
Drainage Coefficient = 0.7

Asphalt Section Traffic (18 kip ESAL) =

Minor Arterial
10,000

Asphalt Pavement Section

Drainage, m

AC Surface + Binder 3.0 in.

Aggregate Base 1.0 6.0 in.

Structural Number: 1.65

Structural Number - Required 1.48

Concrete Section Traffic (18 kip ESAL) =

Minor Arterial
10,000

Concrete Pavement Section

5.0 in.

Project: Washoe County Bus Facility

Location: Sparks NV

Project No. 22034.002

Date: 02/08/22

MAINTENANCE, FUEL, WASH, AND N AND E DRIVEWAY

Pavement Design
(AASHTO 1993 Method)

Design Inputs

Sugrade Support

Asphalt

Concrete

CBR = 7.02

Mr = 8890 psi

k = 168 pci

90 %

%

Reliability

So = 0.45

0.35

Standard Deviation

Po = 4.2

4.5

Initial Serviceability

Pt = 2.0

2.5

Terminal Serviceability

Δ PSI = 2.2

2.0

Design Serviceability Loss,

Layer Coefficients:

AC Surface and Binder $a_1 = 0.35$

Aggregate Base $a_2 = 0.10$

Concrete Compressive Strength = 4000 psi

Modulus of Elasticity of Concrete = 3,600 ksi

Modulus of Rupture of Concrete: = 580

Load Transfer ("J" Factor) = 4.2

Drainage Coefficient = 0.7

Asphalt Section Traffic (18 kip ESAL) =

Minor Arterial

122,000

Asphalt Pavement Section

Drainage, m

AC Surface + Binder

5.0 in.

in.

Aggregate Base

1.0

8.0 in.

in.

Structural Number: 2.55

Structural Number - Required 2.26

Concrete Section Traffic (18 kip ESAL) =

Minor Arterial

122,000

Concrete Pavement Section

7.3 in.

in.

Project: Washoe County Bus Facility

Location: Sparks NV

Project No. 22034.002

Date: 02/08/22

BUS YARD AREA PAVEMENT DESIGN

Pavement Design

(AASHTO 1993 Method)

Design Inputs

Sugrade Support

Asphalt

Concrete

CBR = 7.02

Mr = 8890 psi

k = 168 pci

90 %

Reliability

So = 0.45

0.35

Standard Deviation

Po = 4.2

4.5

Initial Serviceability

Pt = 2.0

2.5

Terminal Serviceability

Δ PSI = 2.2

2.0

Design Serviceability Loss,

Layer Coefficients:

AC Surface and Binder $a_1 = 0.35$

Aggregate Base $a_2 = 0.10$

Concrete Compressive Strength = 4000 psi

Modulus of Elasticity of Concrete = 3,600 ksi

Modulus of Rupture of Concrete: = 580

Load Transfer ("J" Factor) = 4.2

Drainage Coefficient = 0.7

Asphalt Section Traffic (18 kip ESAL) =

Minor Arterial

2,560,000

Asphalt Pavement Section

Drainage, m

AC Surface + Binder

7.0 in.

Aggregate Base

1.0

12.0 in.

Structural Number: 3.65

Structural Number - Required 3.60

Concrete Section Traffic (18 kip ESAL) =

Minor Arterial

2,560,000

Concrete Pavement Section

12.0 in.

Project: Washoe County Bus Facility

Location: Sparks NV

Project No. 22034.002

Date: 02/08/22