OAS Misc Renovations Phase 2 – Soccer Restrooms

For:

Oscoda Area Schools

3550 E. River Rd. Oscoda, MI 48750

Specifications

Issued For:

Bid/Permit
11/21/2025

Prepared by:

THE COLLABORATIVE

One SeaGate, Park Level 118
Toledo, Ohio 43604
Phone: 419-242-7405
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Project No. 107348

TABLE OF CONTENTS

DIVISION 09 – FINISHES

DIVISION 10 – SPECIALTIES

DIVISION 11 – EQUIPMENT (NOT USED)
DIVISION 12 – FURNISHINGS (NOT USED)
DIVISION 13 – SPECIAL CONSTRUCTION (NOT USED)
DIVISION 14 – CONVEYING EQUIPMENT (NOT USED)
DIVISION 21 – FIRE SUPPRESSION (NOT USED)

DIVISION 22 – PLUMBING

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING

END OF DOCUMENT

SECTION 001113 - ADVERTISEMENT FOR BIDS

1.1 GENERAL

A. Sealed proposals for furnishing all labor, materials and equipment necessary for the OAS Misc. Renovation Phase 2 - ADA Soccer Restroom shall be received by Scott Moore , 3550 E River Rd , Oscoda Township, MI 48750 at moores@oscodaschools.org until 2:00 p.m. local time on January 26th. The bids will be publicly opened thereafter.

B. Bidding documents can be found on the Oscoda Area Schools website: https://www.oscodaschools.org/page/open-bids

C. All questions and Requests for Information regarding the plans and specifications will only be given consideration if sent via facsimile or e-mail to Dustin DeWitt, The Collaborative Inc, Fax: 419-242-7400, or e-mail ddewitt@tc.design. Questions received after January 16th will not be answered.

D. Requests for consideration of any Proposed Equal for a specified product, equipment, service, or manufacturer shall be submitted to the Architect no later than 10 calendar days prior to the bid opening. Additional products, equipment, services, or manufacturers shall be approved as Approved Equal only by Addendum.

1.2 PRE-BID CONFERENCE

A. There will be a contractor’s pre-bid conference on during the week of January 12th, at a TBD time, at the Project Site. All bidders are strongly encouraged to attend.

1.3 BIDS AND BONDS

A. Each bid shall be accompanied by a Bid Bond in the amount of 10 percent of the bid or a money order, certified check, or cashiers check in the amount of 10 percent of the bid.

B. Upon award of the contract a 100 percent Performance Bond will be required from the successful bidder.

C. Any and all bonds required to be furnished and delivered pursuant to the Contract including, but not limited to, bid bonds, performance bonds, and/or payment bonds, shall be in conformity with the provisions of the Michigan Building Code. Specifically, any and all bonds required shall be issued and executed by a surety company authorized to conduct business in the State of Michigan and shall be acceptable to the Architect and Oscoda Area School.

D. No bidder may withdraw his or her bid for a period of thirty 30 days after bid opening.

E. The Oscoda Area School may waive any informalities and irregularities, which in its opinion do not materially affect the bid document. The Oscoda Area School also reserves the right to award the contract in a manner which is in the their best interest.

END OF SECTION

SECTION 002113 - INSTRUCTIONS TO BIDDERS

ARTICLE 1 - BIDDING PROCEDURES

1.1 DESCRIPTION AND LOCATION OF PROPOSED WORK

A. Project: OAS Misc. Renovation Phase 2 - ADA Soccer Restroom

B. Location:
3550 E River Rd
Oscoda Township, MI 48750

C. Owner:
Scott Moore
3550 E River Rd
Oscoda Township, MI 48750

1.2 EXAMINATION OF CONTRACT DOCUMENTS AND PROJECT SITE

A. See Notice to Bidders for instructions on how to obtain the Bidding and Contract Documents.

B. The Bidder shall examine all Bidding and Contract Documents, including without limitation the Drawings and Specifications for all divisions of Work for the Project, noting particularly all requirements which will affect the Bidder's Work in any way.

C. Failure of a Bidder to be acquainted with the amount and nature of Work required to complete any applicable division of the Work, in conformity with all requirements of the Project as a whole, will not be considered as a basis for additional compensation.

D. The Bidder shall evaluate the Project site and related Project conditions where the work will be performed, to judge for himself all the factors affecting the cost of the work and time required for its completion, including without limitation the following:
1. The condition, layout, and nature of the Project site and surrounding area, including sub-surface conditions, if applicable.
2. The availability and cost of labor.
3. The availability and cost of materials, supplies and equipment.
4. The cost of temporary utilities required in the bid.
5. The cost of any permit or license required by a local or regional authority having jurisdiction over the project.
6. The generally prevailing climatic conditions; winter conditions and effects of schedule.
7. Conditions bearing upon transportation, disposal, handling, and storage of materials.
8. The cost of all testing as required and called out in specification.

1.3 INTERPRETATION

A. If the Bidder finds any perceived conflict, error, omission or discrepancy between the Drawings and Specifications, or any of the Bidding and Contract Documents, or is in

doubt as to the meaning of any part of the Drawings, Specifications or other Bidding and Contract Documents, the Bidder shall submit a written request to the Architect for an interpretation or clarification.

B. The Bidder shall be responsible for prompt delivery of such request.

C. In order to prevent an extension of the bid opening, the Bidder is encouraged to make all requests for interpretation a minimum of 10 days before the bid opening.
   1. All questions and clarifications shall be faxed or e-mailed to Architect's office as noted in "001113 Advertisement for Bids".

D. The Architect shall issue an Addendum, no later than 72 hours prior to the bid opening, excluding Saturdays, Sundays, and legal holidays, to any and all requests for interpretation of the Bidding and Contract Documents and provide a copy to each person of record holding Drawings and Specifications.
   1. The Addenda shall be deemed to have been validly given if the Addenda is prepared by the Architect and is mailed or otherwise furnished to each person of record holding Drawings and Specifications.
   2. The Addenda shall be numbered when prepared to distinguish it from other Addenda that may be issued at a later date.
   3. Failure of any bidder to receive any such Addenda shall not relieve that Bidder from any obligation of his Bid as submitted.

E. Any interpretation of the Bidding and Contract Documents made by any party other than the Architect, or in any manner other than a written Addendum, shall not be binding and the Bidder shall not rely upon any such interpretation.

F. The Bidder shall not, at any time after the execution of the Contract, be compensated for a claim alleging insufficient data, incomplete Bidding and Contract Documents, or incorrectly assumed conditions regarding the nature or character of the Work, if no request for interpretation was made by the Bidder as specified by these instructions.

1.4 SPECIFICATIONS

A. The articles, devices, materials, equipment, fixtures and other products named in the Drawings or Specifications by Reference Standards, by description only, by naming a specific brand name or catalog number so as to denote kind and quality or by naming one or more manufacturers shall be known as Specifications and all bids shall be based upon those Specifications.

B. Where two or more Specifications are named, the Bidder may furnish any one of those Specifications.

1.5 ALTERNATES OR EQUALS BY SUBSTITUTIONS

A. Proposed alternates or equals to the stated Specifications may only be accepted pursuant to the Requirements for Substitutions.
   1. If the Bidder proposes to use an article, device, material, equipment, form of construction, fixture or other item other than those Specifications named, the Bidder shall certify that the item is equal in quality, and all aspects of performance and appearance, to the Specifications specified.

2. If the Architect approves the proposed Substitution as a Specification, the Architect shall, no later than 72 hours prior to the bid opening, excluding Saturdays, Sundays and legal holidays, issue an Addendum to all Bidders.
3. The Architect shall have the discretion to reject a proposed Substitution for the reason that the Bidder failed to provide sufficient information to enable the Architect to evaluate the proposed Substitution without delay in the scheduled bid opening.
4. No consideration shall be given to any proposed Substitution unless submitted to the Architect at least10 days prior to the bid opening.

1.6 FORM OF PROPOSAL (BID FORM)

A. Each bid shall be submitted on the Form of Proposal Bid Form contained in this Specification/Project Manual and sealed in an submitted via email, indicating the Project name, trades bidding, and the bid date, in the subject line. The wording of the Form of Proposal Bid Form shall be used without change, alteration, or addition.

B. Any change, alteration or addition in the wording of the Form of Proposal Bid Form may cause the bid to be rejected.

C. Unless the Bidder withdraws the bid as provided in Article 3 hereof, the Bidder shall be required to comply with all requirements of the Bidding and Contract Documents, regardless of whether the Bidder had actual knowledge of the requirements and regardless of any statement or omission made by the Bidder which might indicate a contrary opinion.

D. The Bidder shall fill in all blank spaces in the Form of Proposal Bid Form in ink or typewritten and not in pencil.
   1. “Not Applicable” or “N/A” must be used to fill spaces that are not applicable to the Bidder’s Bid.

E. The Bidder shall show all bid amounts in both words and figures.
   1. In the case of a conflict between the words and figures, the amount shown in words shall govern amount shown in words shall govern.

F. Any alteration or erasure of the wording and/or figures of the Bid amount on the Form of Proposal Bid Form shall be initialed by the Bidder.

G. Voluntary Alternates Bids shall be considered as unsolicited. Voluntary Alternate Bids will not be considered in awarding this contract, and the inclusion of any such Voluntary Alternate Bids may result in a bid being considered informal and liable to rejection.

H. The Owner reserves the right to accept or reject any or all bids on specified Alternates, in whole or in part.
   1. If no change in the bid amount is required, indicate “No Change” or “$0 Dollars”.
   2. A blank entry or an entry of “No Bid”, “N/A”, or similar entry on any specified Alternate that are applicable to a Bidder’s Bid will cause the bid to be rejected only if that Alternate is selected.

I. An officer or a principal of the corporation, partnership or sole proprietorship shall print or type the legal name of the business entity on the line provided and sign the Form of

Proposal Bid Form. All signatures must be original. The same procedure shall apply to the bid of a joint venture, except that the signature and title of an officer or a principal of each member firm of the joint venture shall be required.

1. **For bids submitted electronically via email, submit a digitally scanned copy of the Proposal Form showing original signatures.**

1.7 UNIT PRICES

A. When Unit Prices are requested on the Form of Proposal Bid Form, the scheduled quantities, if listed, are to be considered as approximate and are to be used for the comparison of bids only.

B. Unless otherwise specified in the Bidding and Contract Documents, the Unit Prices set forth shall include all materials, equipment, labor, delivery, installation, overhead, profit and any other cost or expense, in connection with or incidental to, the performance of that portion of the Work to which the Unit Prices apply.

C. Where there is a conflict between the Unit Price and the extension thereof made by the Bidder, the Unit Price shall govern and the Owner is authorized to make a correct extension of such Unit Price shall be made and such corrected extension shall be used in comparing bids.

D. It is understood that the scheduled quantities of Work to be done and materials to be furnished may increase, decrease or be deleted entirely after execution of the Contract.

E. Payments will be made to the Contractor for only the actual quantities of Work performed or materials furnished under Unit Prices in accordance with the Bidding and Contract Documents.

F. If quantities stated in the Contract change substantially so that application of the agreed Unit Price to the quantities of Work proposed will create a hardship on either the Owner or the Contractor, the applicable Unit Prices may be equitably adjusted by a Change Order.

ARTICLE 2 - BID OPENING AND CONSIDERATION OF BIDS

2.1 DELIVERY OF BIDS

A. It is the responsibility of the Bidder to submit the bid prior to the time scheduled for the bid opening, at the email address specified in the “Notice to Bidders”.

B. The subject line of the email with the bid submission shall clearly note the Projectname, Bidder's name, and trades bidding.

2.2 BID EVALUATION CRITERIA AND PROCEDURE

A. The award of the contract shall be made to a Bidder who submits a responsive and responsible Bid which meets the requirements of the Bidding and Contract Documents and who is deemed by the Owner to be fully capable of completing the Work in accordance with the Drawings, Specifications and other Bidding and Contract Documents within the time allotted.

B. The Owner reserves the right to evaluate any Bidder's proposed subcontractors.

C. The consideration of the criteria specified in no manner limits the Owner's discretion in awarding the contract.

2.3 REJECTION OF BID BY THE OWNER

A. The Owner may reject any or all bids, in whole or in part, on any basis and without disclosure of a reason, and waive all informalities and technicalities. The failure to make such a disclosure shall not result in accrual of any right, claim, or cause of action by any unsuccessful Bidder against the Owner.

2.4 NOTICE OF AWARD

A. The Owner shall notify the apparent successful Bidder that upon satisfactory compliance with all conditions precedent for Contract execution (Article 5.4), within the time specified, the Bidder will be awarded a Contract.

B. The Owner reserves the right to rescind any Notice of Award if the Owner determines the Notice of Award was issued in error.

ARTICLE 3 - WITHDRAWAL OF BID

3.1 WITHDRAWAL PRIOR TO BID OPENING

A. A Bidder may withdraw a bid after the bid has been received by the Owner, provided the Bidder makes a request in writing and the request is received by the Owner prior to the time of the bid opening, as determined by the employee of the Owner designated to open the bids.

3.2 WITHDRAWAL AFTER BID OPENING

A. A Bidder may withdraw a bid from consideration after the bid opening if the bid amount was substantially lower than the amounts of other bids, providing the bid was submitted in good faith, and the reason for the bid amount being substantially lower was a clerical mistake, as opposed to a judgment mistake, and was actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of Work, labor or materials made directly in the compilation of the bid amount.

B. Notice of a request to withdraw such a bid must be made in writing and filed with the Owner, with a copy to the Architect, within 2 business days after the bid opening.

C. If a bid is withdrawn under authority of paragraph 3.2.A, the Owner may award the Contract to another Bidder or reject all bids and advertise for other bids. In the event the Owner advertises for other bids, the withdrawing Bidder shall pay the costs, in connection with the rebidding including but not limited to printing new Bidding and Contract Documents, required advertising and printing and mailing notices to prospective Bidders, if the Owner finds that such costs would not have been incurred but for such withdrawal.

ARTICLE 4 - BID SECURITY SUBMITTED WITH BID

4.1 BOND REQUIREMENTS

A. The Bidder must file with the bid either:
   1. A Bond, payable to the Owner in the form of a bid bond in the amount equal to 10 percent of the Base Bid plus all add Alternates;
   2. A Certified Check, Cashier's Check, or Money Order in an amount equal to but not less than 10 percent of the Base Bid plus all add Alternates.
   3. If chosen, the bid security must be drawn on a solvent bank or savings and loan association.
   4. **For bids submitted electronically, electronic proof of bid security is acceptable.**

B. The Bond shall serve as an assurance that the Bidder will, upon acceptance of the bid, comply with all conditions precedent for Contract execution, within the time specified by the Owner.

C. If the blank line on the Bond form is not filled in, the penal sum will be the full amount of the Base Bid plus all add Alternates. If the blank line is filled in, the amount must be stated in dollars and cents.

D. The Bond must be signed by an authorized agent, with Power of Attorney, from a Surety. The Bond must be issued by a Surety authorized by the Department of Insurance to transact business in the State in which the project is located.

E. In every case where a Bond is required, should any Surety thereon, in the opinion of the Owner, become unacceptable as a Surety at any time prior to the completion of the Project and acceptance of the Work, the Contractor shall promptly furnish a replacement Surety that is acceptable to the Owner.

F. Bonds or checks will be returned to all unsuccessful Bidders upon execution of the Contract or within 60 days after the bid opening, whichever is soonest.

4.2 BOND FORFEITURE

A. If for any reason other than as authorized above the Bidder fails to enter into a Contract, and the Owner awards the Contract to another responsive and responsible Bidder, the Bidder who failed to enter into a Contract shall be liable to the Owner for a penal sum not to exceed 10 percent of the bid bond, or the full amount of the certified check, cashier's check, or money order.

B. If the Owner then awards a Contract to such next lowest responsive and responsible Bidder and such Bidder also fails or refuses to enter into a contract, the liability of such next lowest responsive and responsible Bidder shall be the amount of the difference between the bid amounts of such second responsive and responsible Bidder and the third lowest responsive and responsible Bidder, but not in excess of the liability specified in paragraph 3.2.C. Liability on account of an award to any other responsive and responsible Bidder beyond the third lowest Bidder shall be determined in like manner, pursuant to the laws of the State in which the project is located.

C. If the Bidder fails to enter into a Contract, and the Owner does not award the contract to another responsive and responsible Bidder but resubmits the Project for bidding, the Bidder failing to enter into the contract shall be liable to the Owner for a penal sum not to exceed 10 percent of such Bidder's bid amount or the costs in connection with the resubmission, of printing new Bidding and Contract Documents, required advertising and printing and mailing notices to prospective Bidders, whichever is less, pursuant to the laws of the State in which the project is located.

4.3 PERFORMANCE BOND REQUIREMENTS

A. If the Bidder enters into a contract, and had previously provided either a bid bond, money order, cashier's check, or certified check with their Bid, then prior to signing the Contract the Bidder may be required to provide a Performance Bond meeting the requirements of the laws of the State in which the project is located. Upon receipt of the Performance Bond, the Owner shall return the Check or Money Order to the Bidder.

B. The Performance Bond shall be in the full amount of the contract to indemnify the Owner against all direct and consequential damages suffered by failure of the Contractor to perform according to the provisions of the contract and in accordance with the Drawings, Specifications and bills of material therefor and to pay all lawful claims of Subcontractors, Material Suppliers, and laborers for labor performed or materials furnished in carrying forward, performing or completing the contract.

ARTICLE 5 - CONTRACT AWARD AND EXECUTION

5.1 AWARD AND EXECUTION

A. The award and execution of the contract is based upon the expectation that the [lowest] responsive and responsible Bidder will comply with all conditions precedent for contract execution within 10 days of the date of the Notice of Award.

B. Noncompliance with the conditions precedent for contract execution within 10 days of the date of the Notice of Award shall be cause for the Owner to cancel the Notice of Award and award the contract to another responsive and responsible Bidder or resubmit the contract for bidding, at the discretion of the Owner. The Owner may extend the time for submitting the conditions precedent for contract execution for good cause shown. No extension shall operate as a waiver of the conditions precedent for contract execution.

C. Failure to award and execute the contract within 30 days of the bid opening invalidates the entire bid process and all bids submitted, unless the time is extended by written consent of the Bidder whose bid the Owner has accepted, and concurrence of the Owner with such extension.
   1. If the contract is awarded within 30 days of the bid opening, any increases in material, labor and subcontract costs shall be borne by the Bidder without alteration of the amount of the bid.
   2. If the cause of the failure to execute the contract within 30 days of the bid opening is due to matters for which the Owner is solely responsible, the Contractor shall be entitled to a Change Order authorizing payment of verifiable increased costs in materials, labor or subcontracts.

3. If the cause of the failure to execute the contract within 30 days of the bid opening is due to matters for which the Contractor is responsible, no request for increased costs will be granted.

5.2 CONDITIONS PRECEDENT FOR EXECUTION OF CONTRACT

A. If a Performance Bond is required to support the Bond, a Certificate of Compliance issued by the appropriate governing agency, showing the Surety is licensed to do business in the State in which the Project is located.

B. Current Workers' Compensation Certificate as required by the State governing authority.

C. Certificate of Insurance (ACORD form is acceptable) and copy of additional insured endorsement.
   1. The Owner reserves the right to request a certified copy of the Contractor's insurance policies.

5.3 NOTICE TO PROCEED

A. The Owner shall issue the Contractor a Notice to Proceed which shall establish the date for commencement of the Project time.

B. The Contractor shall, within 10 days of the date of the Notice to Proceed unless they have been previously submitted with the Bid, furnish the Architect with the following submittals:
   1. Schedule of values.
   2. Preliminary schedule of Shop Drawings and Submittals.
   3. Subcontractor's Declaration.
   4. Manufacturer's Declaration.
   5. Outline of Qualifications of Proposed Superintendent.

END OF SECTION

SECTION 003100 - AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.1 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders, as follows:

B. Hazardous Material Survey: Entitled Oscoda Area Schools 2023 3 Year Re-Inspection Report, dated November 05, 2023 .

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 004200 - PROPOSAL FORM

SEALED BIDS WILL BE RECEIVED UNTIL: 2:00 P.M., ON JANUARY 26TH VIA EMAIL TOO:

SCOTT MOORE

MOORES@OSCODASCHOOLS.ORG

3550 E RIVER RD, OSCODA TOWNSHIP, MI 48750

NAME OF BIDDER: _____

ADDRESS OF BIDDER: _____

FORM OF PROPOSAL

FOR:

OAS MISC. RENOVATION PHASE 2 - ADA SOCCER RESTROOM

OSCODA AREA SCHOOLS

3550 E RIVER RD, OSCODA TOWNSHIP, MI 48750

SUMMARY

GENTLEMEN/LADIES:

We, the undersigned, having carefully examined the Drawings and Specifications, together with all Addenda, prepared by The Collaborative, One Seagate, Park Level 118, Toledo, Ohio 43604; propose the following:

In submitting this Bid Proposal, it is agreed:

1. To maintain conditions for 30 days following the bid opening date.
2. To accept provisions of the "Notice to Bidders" and "Instructions to Bidders".
3. To execute a contract awarded on the basis of this proposal within10 days after being notified of the Owner's intentions.
4. Bidder has examined the existing conditions where the Work is to be performed, the legal requirements and local conditions affecting cost, progress, furnishing or

performance of the Work and has made such independent investigations as Bidder deems necessary.

5. This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any Agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not sought by collusion to obtain for himself any advantage over any other Bidder or over Oscoda Area School.

EMAILED BID PACKAGE MUST INCLUDE:

A. Signed Bid Form.

B. Bid Guaranty and Contract Bond (Or as otherwise allowed in the Instructions to Bidders).

GENERAL INFORMATION

A. In accordance with applicable law, The Collaborative Inc. on behalf of the Oscoda Area School is soliciting bids, and shall award to the lowest responsive and responsible bidder(s). Low bids shall be determined in accordance with the Bid evaluation procedure detailed in Instruction to Bidders.

B. The bidder acknowledges the right of the Oscoda Area School to reject any or all bids on any basis and without disclosure of a reason.

C. The bidder acknowledges the right of the Oscoda Area School, in evaluating any bid, to waive any or all informalities, irregularities and technicalities.

D. The bidder also acknowledges the right of the Oscoda Area School to reject low bid if:
   1. The bid is in any way incomplete or irregular, or if for any other reason the bidder is determined to be “non-responsive.”
   2. The bidder is determined to be “non-responsible” due to past performance history, financial problems, not having sufficient manpower and equipment to execute the work or other criteria as indicated in the Instructions to Bidders.
   3. If post bid information does not indicate experience similar in scope to the work for which bid is submitted.
   4. Bidder’s history on similar past projects, including claims against previous Owner(s).

SINGLE PRIME CONTRACT BID

ALL TRADES BASE BID:

A. Bid proposal for all labor and material as described in the contract document for all Trades Base Bid stated below:

All labor and material, for the sum of: $_____.
Sum in words:
_____Dollars.

PERFORMANCE BOND

A. Cost to provide 100 percent perfomance bond as specified: $_____.

Sum in words: _____
Dollars.

PROJECT COMPLETION:

A. The Contractor shall diligently prosecute the Work and shall effect Contract Completion following the date set forth in the Notice to Proceed, unless an extension of time is granted in accordance with the Contract Documents.

B. The Owner will provide complete access to the project site beginning on the date established in the Notice to Proceed.

ADDENDUM RECEIPTS:

A. The receipt of the following addenda to the Drawings and Specifications is hereby acknowledged:

1. No: _____ Date:_____
2. No: _____ Date:_____
3. No: _____ Date:_____
4. No: _____ Date:_____

REJECTION OF BIDS:

A. In submitting this Bid, it is understood that the right is reserved by the Owner to reject any and all bids or to waive informalities in bidding. It is agreed that this bid may not be withdrawn for a period of 30 days from the opening thereof.

CERTIFICATION

A. _____(Name of Contractor) does hereby understand and acknowledge the representations in this Proposal are important, material and contractual, and not mere recitals, in addition to the following affirmations.

B. The Bidder has read and understands the Plans and Specifications, and all Addenda, to the extent that such documents relate to the work for which the Bid is submitted, and that the Bid is based upon the materials, equipment, and systems required by the Plans and Specifications, and all Addenda, without exception, unless the Bidder lists Material Substitution in this Proposal.

C. The Bidder has visited the site, become familiar with local conditions, performed any tests required and has correlated personal observations about the requirements of the Plans and Specifications. The Bidder has no outstanding questions regarding the interpretation of the Plans, Specifications, and Contract Documents, other than those which may have been submitted to the ARCHITECT in writing prior to the Bid opening. Bidders will not receive additional payment or be granted an extension of time for conditions, which the Bidder could have determined by examining the site.

D. The Bidder acknowledges that the sole remedy for: (1) any delay in the commencement, prosecution, or completion of the work; (2) hindrance or obstruction in the performance of the work; (3) loss of productivity; or (4) other similar claims, whether or not such delays are foreseeable, is an extension of time in which to complete the work by an amount equal to the time lost due to delays beyond the control of the Contractor. In no event shall the Contractor be entitled to any other compensation or recovery of any damages in connection with any delay, including, without limitation, costs of acceleration, consequential damages, lost opportunity costs, impact damages, lost profits, extended field or office overhead, or other similar remuneration.

E. All statements contained in this Proposal or Bid are true and further, that the prices which have been quoted in the Proposal have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder prior to opening, directly or indirectly, to any other Bidder or to any competitor.

F. The Bidder will enter into and execute a Contract with the OWNER when awarded on the basis of this Bid, and in connection therewith to furnish all Bonds and insurance in accordance with the Bidding Documents, accomplish the work in accordance with the Contract, and complete all work within the specified time.

G. When the Bid Security furnished is to be a Bid Guaranty and Contract Bond, the Bidder certifies that they have notified a Surety Company that a Bid has been submitted and the Surety Company has issued a Bid Guaranty and Contract Bond for the Work if the Bid is accepted and the Bidder is awarded a Contract. The Bidder agrees to accept the provisions of the Instructions to Bidders regarding disposition of Bid Security.

H. When the Bid Security furnished is to be a Bid Bond, the Bidder certifies that they have notified a Surety Company that a Bid has been submitted and the Surety Company has issued a Bid Bond. The Bidder agrees to accept the provisions of the Instructions to Bidders regarding disposition of Bid Security and to provide, if required, a 100%

Performance Bond for the Work if the Bid is accepted and the Bidder is awarded a Contract.

I. When the Bid Security furnished is to be other than a Bond, as allowed for in the Instructions to Bidders, the Bidder agrees to accept the provisions of the Instructions to Bidders regarding disposition of Bid Security and to provide, if required, a 100% Performance Bond for the Work if the Bid is accepted and the Bidder is awarded a Contract.

J. If the Bidder is a corporation, partnership or sole proprietorship, an officer, partner or principal of the Bidder, as applicable, shall print or type the legal name of the Bidder on the line provided and SIGN THE BID FORM. If the Bidder is a joint venture, an officer, partner or principal, as applicable, of each member of the joint venture shall print or type the legal name of the applicable member on the line provided and sign the Bid Form. All signatures must be original.

RESPECTFULLY SUBMITTED,

_____

(Firm Name)

By _____ ____/____/____

(Signed Name) (Date)

_____

(Typed Name)

_____

(Title)

Official Address:

_____

_____

_____

Phone: (_____) - _____ - _____

END OF SECTION

SECTION 005000 - CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.1 AGREEMENT AND CONDITIONS OF THE CONTRACT

A. See Section 005200 - Agreement Form for the Agreement form to be executed.

B. See Section 007200 - General Conditions for the General Conditions.

C. See Section 007300 - Supplementary Conditions for the Supplementary Conditions.

D. The Agreement is based on AIA A101.

E. The General Conditions are based on AIA A201.

1.2 FORMS

A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.

B. Bond Forms:
   1. Bid Bond Form: AIA A310.

C. Post-Award Certificates and Other Forms:
   1. Schedule of Values Form: AIA G703.
   2. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).

D. Clarification and Modification Forms:
   1. Substitution Request Form: CSI/CSC Form 1.5C (During the Bidding/Negotiating Stage).
   2. Substitution Request Form: CSI/CSC Form 13.1A (After the Bidding/Negotiating Stage).
   3. Architect's Supplemental Instructions Form: AIA G710.
   4. Construction Change Directive Form: AIA G714.
   5. Change Order Form: AIA G701.

E. Closeout Forms:
   1. Certificate of Substantial Completion Form: AIA G704.
   2. Contractor’s Affidavit of Release of Liens Form: AIA G706A
   3. Consent of Surety to Final Payment Form: AIA G707.

1.3 REFERENCE STANDARDS

A. AIA A101 - Standard Form of Agreement Between Owner and Contractor where the basis of Payment is a Stipulated Sum; 2017.

B. AIA A201 - General Conditions of the Contract for Construction; 2017.

C. AIA A310 - Bid Bond; 2010.

D. AIA G701 - Change Order; 2017.

E. AIA G702 - Application and Certificate for Payment; 1992.

F. AIA G703 - Continuation Sheet; 1992.

G. AIA G704 - Certificate of Substantial Completion; 2017.

H. AIA G706A - Contractor’s Affidavit of Release of Liens; 1994.

I. AIA G707 - Consent of Surety to Final Payment; 1994.

J. AIA G710 - Architect's Supplemental Instructions; 2017.

K. AIA G714 - Construction Change Directive; 2017.

L. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.

M. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 007300 - SUPPLEMENTARY CONDITIONS

GENERAL

The following supplements modify AIA Document A201-2017, General Conditions of the Contract for Construction. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of General Conditions remain in effect.

ARTICLE 1 GENERAL PROVISIONS

Add Sections 1.2.1.2 through 1.2.1.5 to Section 1.2.1:

1.2.1.2 In the event of conflicts or discrepancies among Contract Documents, interpretations will be based on the following priorities:

1.2.1.2.1 Modifications, including Bulletins, CCD and ASI.

1.2.1.2.2 The Agreement.

1.2.1.2.3 Addenda, with those of later date having precedence over those of earlier date.

1.2.1.2.4 The Supplementary Conditions.

1.2.1.2.5 The General Conditions of the Contract for Construction.

1.2.1.2.6 Division I of the Specifications.

1.2.1.2.7 Drawings and Divisions 2 – 49 of the Specifications.

1.2.1.2.8 Information included in larger scale details shall take precedence over smaller scale details.

1.2.1.2.9 Other documents specifically enumerated in the Agreement as part of the Contract Documents.

1.2.1.3 In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided unless the Architect instructs otherwise in writing.

1.2.1.4 If an item is shown on the Drawings but not specified, the Contractor shall provide the item of the same quality as similar items specified, unless the Architect instructs otherwise in writing. If an item is specified but not shown on the Drawings, it shall also be provided and located as directed by the Architect.

1.2.1.5 The Drawings are indications of the design intent as well as specific instructions. The “details” included on Drawings show the intent of all similar areas. If questions arise about the construction of an area not specifically detailed, consult with the Architect who will provide further “details” and instructions. Such further documentation, if consistent with the Contract Documents, shall not alter the Contract Sum.

Add Section 1.7.1 to Section 1.7:

1.7.1 Contractor to refer to the Architect's Electronic File Transfer Agreement. A copy will be provided upon request.

ARTICLE 3 CONTRACTOR

Add Section 3.2.2.1 to Section 3.2.2:

3.2.2.1 Do not scale the Drawings. Follow indicated dimensions. In case of discrepancy in the figures, bring the matter to the attention of the Architect for interpretation before proceeding with the Work. Failure to follow this procedure shall be at the Contractor’s own risk, and the Architect’s interpretation shall be final.

Add the following Section 3.2.5 to Section 3.2:

3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for evaluating and responding to the Contractor’s requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, contractor-prepared coordination drawings, or prior Project correspondence or documentation.

Add Section 3.4.2.1 to Section 3.4.2:

3.4.2.1 After the Contract has been executed, the Owner and Architect will consider requests for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division I of the Specifications). By making requests for substitutions, the Contractor:

3.4.2.1.1 represents that is has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

3.4.2.1.2 represents that it will provide the same warranty for the substitution as it would have provided for the product specified;

3.4.2.1.3 certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be changed as a result of the substitution, except for the Architect's redesign costs, and waives all claims for additional costs related to the substitution that subsequently become apparent; and

3.4.2.1.4 shall coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

Add Section 3.4.2.2 to Section 3.4.2:
3.4.2.2 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Architect for reviewing the Contractor's proposed substitutions and making agreed-upon changes in the Drawings and Specifications resulting from such substitutions.

Add Section 3.6.1 to Section 3.6:
3.6.1 T**he following applies to Ohio tax exempt projects:** All materials and labor that ultimately become a part of the completed structure or improvement that constitutes the Project will be exempt from State Sales Tax as provided in Section 5739.02, ORC, and State Use Tax as provided in Section 5741.01, ORC. The purchase, lease or rental of material, equipment, parts or expendable items such as form lumber, tools, oils, greases and fuels, which are used in connection with the Work, are subject to the application of State Sales Tax and State Use Tax.

Add Section 3.7.1.1 to Section 3.7.1:
3.7.1.1 The Owner shall secure and pay for the Basic Building Permit - all other permits and governmental fees, licenses and inspection necessary for the proper execution and completion of the Work shall be the responsibility of the Contractor whose trade requires such.

Add Section 3.12.11 to Section 3.12:
3.12.11 The Architect's review of Contractor's submittals will be limited to examination of an initial submittal and One (1) Resubmittals. The Owner is entitled to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of additional submittals.

ARTICLE 4 ARCHITECT

Add Section 4.2.2.1 to Section 4.2.2:
4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor of by defects and deficiencies in the Work.

Add Section 4.2.14.1 to Section 4.2.14:
4.2.14.1 Contractor's requests for information shall be prepared and submitted in accordance with Division 1 "General Requirements" sections on the form included in the Contract Documents. The Architect will return without action requests for information that do not conform to the requirements of the Contract Documents.

ARTICLE 5 SUBCONTRACTORS

Add Section 5.2.5 to Section 5.2:

5.2.5 If the Owner or Architect has reasonable objections to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected manufacturer or fabricator was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute manufacturer's or fabricator's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

Add Sections 6.2.1.1 through 6.2.1.3 to Section 6.2.1:

6.2.1.1 The Contractor shall perform the Work so as to not interfere, disturb, hinder or delay the Work of other Contractors. The sole remedy which may be provided by the Owner for any injury, damage or expense resulting from interference, hindrance, disruption or delay caused by or between Contractors or their agents and employees shall be an extension of time in which to complete the Work.

6.2.1.2 Should the Contractor, or the Contractor's Subcontractors or Material Suppliers, cause damage or injury to the property or Work of any other Contractor, or by failure to perform the Work with due diligence, delay, interfere, hinder or disrupt any Contractor who suffers additional expense or damage thereby, the responsible Contractor shall be responsible for such damage, injury or expense.

6.2.1.3 Claims, disputes or actions between Contractors concerning such damage, injury or expense shall not delay completion of the Work which shall be continued by the parties to any such dispute, action or claim.

ARTICLE 7 CHANGES IN THE WORK

Add Section 7.1.4 to Section 7.1:

7.1.4 For each change in the Work, the Contractor shall furnish a detailed Proposal itemized on the Change Order Detail Summary Form published by the Architect Office. Any Subcontractor of Material supplier pricing shall be also itemized on the Change Order Estimate Summary Form. The combined overhead and profit included in the total cost to the Owner for a change in the Work shall be based on the following schedule:

7.1.4.1 For the Contractor, the Work performed by the Contractor's own forces, 10 percent of the cost.

7.1.4.2 The Contractor, the work performed by the Contractor's Subcontractors, 5 percent of the amount due the Subcontractors.

7.1.4.3 For each Subcontractor involved, the Work performed by that Subcontractor's own forces, 10 percent of the cost.

7.1.4.4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, 5 percent of the amount due the Sub-subcontractor.

ARTICLE 8 TIME

Add Section 8.2.3.1to Section 8.2.3:

.1 The Owner has the right to direct the Contractor to work overtime as the Owner deems necessary. Reimbursement for such work shall be limited to actual premium time cost incurred without markup.

Add Section 8.2.4 to Section 8.2:

8.2.4 Recovery Schedule: If it is apparent to the Owner or the A/E that the Contractor may be unable to meet critical path activities, Milestone completion dates, or the Contract Completion date; the Contractor shall submit within 3 days a recovery plan to avoid or minimize the delay to the Project.

A recovery plan shall include, but is not limited to, adjustments to one or more of the following:

.1 Workforce
.2 Hours per shift
.3 Shifts per workday
.4 Workdays per week
.5 Equipment
.6 Activity logic

Add Sections 8.4 and 8.5 to Article 8:

8.4 REQUEST FOR EXTENSION

8.4.1 Any request by the Contractor for an extension of time shall be made in writing to the Architect no more than ten (10) days after the initial occurrence of any condition which, in the Contractor's opinion, entitles the Contractor to an extension of time. Failure to timely provide such notice to the Architect shall constitute a waiver by the Contractor of any claim for extension, damages or mitigation of Liquidated Damages, to the fullest extent permitted by law.

8.4.2 The Contractor shall notify the Architect in writing providing the following information:

8.4.2.1 Nature of the interference, disruption, hindrance or delay;

8.4.2.2 Identification of persons, entities and events responsible for the interference, disruption, hindrance or delay

8.4.2.3 Date (or anticipated date) of commencement of the interference, disruption, hindrance or delay

8.4.2.4 Activities on the Construction Schedule which may be affected by the interference, disruption, hindrance or delay, or new activities created by the interference, disruption, hindrance or delay and the relationship with existing activities

8.4.2.5 Anticipated duration of the interference, disruption, hindrance or delay;

8.4.2.6 Specific number of days of extension requested; and

8.4.2.7 Recommended action to avoid or minimize and future interference, disruption, hindrance or delay.

8.5 CRITICAL PATH

8.5.1 Notwithstanding any other provision of the Contract Documents, time extensions will depend upon the extent to which the Work on the Critical Path of the Construction Schedule is affected, if applicable.

8.5.2 A Change Order granting a time extension may provide that the Contract Completion date will be extended for only those specific elements so interfered, disrupted, hindered or delayed and that remaining milestone completion dates will not be altered and may further provide for equitable adjustment of Liquidated Damages.

ARTICLE 9 PAYMENTS AND COMPLETION

Add the following sentence to the end of Section 9.3.1:

9.3.1 The form of Application of Payment, duly notarized, shall be a current authorized edition of AIA Document G702 TM – 1992, Application and Certificate for Payment, supported by a current authorized edition of AIA Document G703 TM – 1992 Continuation Sheet.

Add Section 9.3.1.3 to Section 9.3.1:

9.3.1.3 In the absence of retainage language specified elsewhere in the contract documents, until Substantial Completion, the Owner shall pay 95 percent of the amount due the Contractor on account of progress payments.

Add the following Section 9.10.1.1 to Section 9.10.1:

9.10.1.1 The Architect will perform no more than one inspection(s) to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents and no more than one inspection(s) to determine the work has attained a final Completion in accordance with the contract documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for any additional inspections.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

Add Sections 10.2.7.1 and 10.2.7.2 to Section 10.2.7:

10.2.7.1 The Contractor shall shore up, brace, underpin and protect as may be necessary, all foundations and other parts of existing structures adjacent and adjoining the site which are in any way affected by the Contractor's operations. Whenever notice is required to be given by the Owner or the Contractor to an adjoining or adjacent landowner or other party before commencement of the Work of this Project, such notice shall be given by the Contractor. The Contractor shall indemnify and save harmless the Owner from damages on account for which the Owner may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

10.2.7.2 The Contractor shall exercise precaution at all times for the protection of persons and property. The safety provisions of applicable laws, building and construction codes shall be observed. Machinery, equipment and other hazards shall be guarded in accordance with the provisions of the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, to the extent that such provisions are not in contravention of applicable law.

ARTICLE 11 INSURANCE AND BONDS

DELETE Section 11.1 and Insert the following:

11.1 CONTRACTOR'S INSURANCE AND BONDS

11.1.1 Contractor's Liability Insurance

11.1.1.1 The Contractor shall purchase and maintain liability and other insurance as will protect the Contractor from claims set forth below, which may arise out of, or result from, the Contractor's performance or obligations under the Contract Documents, whether due to action or inaction by the Contractor or any Person for whom the Contractor is responsible.

11.1.1.1.1 Claims under workers' compensation, occupational sickness or disease, disability benefit, and other similar employee benefit acts;
11.1.1.1.2 Claims for damages because of bodily injury, disease, illness, death, or personal injury, and other claims usually covered by bodily injury liability insurance;
11.1.1.1.3 Claims for damages because of injury to, or destruction of, property and other claims usually covered by property damage liability insurance.

11.1.1.2 The Contractor shall purchase and maintain a Commercial General Liability policy and Business Automobile Liability policy to provide insurance and limits as indicated below. An Umbrella or Excess Liability policy may be used to reach the required limits.

Policy Limits – Commercial General Liability
$2,000,000 General Aggregate (minimum – see below)
$2,000,000 Products/Completed Operations Aggregate

$1,000,000 Occurrence Limit (minimum – see below)
$1,000,000 Personal and Advertising Injury Limit
$100,000 Fire Legal Liability Limit
$10,000 Medical Payments

Policy Limits – Business Automobile
$500,000 Combined Single Limit

11.1.1.2.1 Contracts in the amount of $100,000 or less require coverage in the amount of not less than $2 million general aggregate and $1 million per occurrence.
11.1.1.2.2 Contracts in excess of $100,000, but not more than $5 million, require coverage in the amount of not less than $3 million general aggregate and $3 million per occurrence.
11.1.1.2.3 Contracts exceeding the amount of $5 million require coverage in an amount to be determined by the Owner Contracting Authority and identified in the Supplementary Conditions, but in no case less than $5 million general aggregate and $5 million per occurrence.
11.1.1.2.3.1 Policies shall be endorsed to provide that the General Aggregate Limit applies separately to each of the insured Contractor's projects.

11.1.1.3 For any demolition, blasting, excavating, tunneling, shoring, or similar operations, the Contractor shall provide and maintain Property Damage Liability insurance with a limit of liability equal to the limit as specified in the applicable sections of subparagraph 11.1.1.2.

11.1.2 Builder's Risk Insurance

11.1.2.1 The Lead Contractor shall provide and maintain, during the progress of the Work and until the execution of the Certificate of Substantial Completion by the Owner, a Builder's Risk insurance policy to cover all Work in the course of construction including false-work, temporary buildings and structures, and materials used in the construction process, stored on or off-site, or while in transit. This insurance shall be on a special cause of loss form, which provides coverage on an open perils basis insuring against the direct physical loss of, or damage to, covered property including, but not limited to, theft, vandalism, malicious mischief, earthquake, tornado, lightning, explosion, breakage of glass, flood, collapse, water damage, and hot and cold testing. This insurance shall be written on a replacement cost basis and shall also include debris removal, and/or demolition occasioned by enforcement of Applicable Law.
11.1.2.1.1 The amount of coverage shall be not less than the total completed value of the Project, including the value of permanent fixtures and decorations, with a deductible of not more than $25,000 per occurrence. Any deductible over the amount specified must be authorized in writing by the Owner.
11.1.2.1.2 Coverage shall include a provision to pay the reasonable extra costs of acceleration and expediting temporary and permanent repairs to, or permanent

replacement of, damaged property. This shall include overtime wages and the extra cost of "express" or other means for rapidly transporting materials and supplies necessary to the repair or replacement.

11.1.2.1.3 Coverage shall include “soft cost endorsement” including, but not limited to, the reasonable extra costs of the A/E and reasonable Contractor extension or acceleration costs.

11.1.2.1.4 Coverage shall include material in transit or stored off-site and identified for the Project.

11.1.2.1.5 Coverage shall waive all rights between the Owner, the Contractor, and Subcontractors at any tier, for damages caused by fire or any other perils to the extent of actual recovery of any insurance proceeds under the policy.

11.1.2.1.6 Coverage shall include appropriate sub-limits for installation coverage.

11.1.2.1.7 Coverage shall include provisions for mechanical or electrical breakdown, or boiler system testing.

11.1.2.1.8 Coverage shall include temporary structures and scaffolding, along with collapse coverage.

11.1.2.1.9 Coverage shall be primary to all other applicable insurance.

11.1.2.1.10 The Builder's Risk policy shall specifically permit and allow for Partial Occupancy by the Owner prior to execution of the Certificate of Substantial Completion by the Owner Contracting Authority and coverage shall remain in effect until all punch list items are completed.

11.1.2.1.11 The Contractor’s tools and equipment shall not be covered under the Builder’s Risk policy. It is the Contractor’s sole responsibility to maintain such coverage, which shall be included in its overhead and not included as a separate item in the Contractor’s Schedule of Values.

11.1.2.2 If the Contractor is involved solely in the installation of material and equipment and not in new building construction, the Contractor shall purchase and maintain a Builder's Risk, Builder's Risk-Renovations, or Installation Floater insurance policy. The policy must comply with the provisions of subparagraph 11.1.2.1.

11.1.3 Insurance Policy Requirements

11.1.3.1 Each policy of insurance required to be purchased and maintained by the Contractor shall name the Owner as an additional insured or loss payee, as applicable; provided, however, this designation shall not cause any claim between the Contractor and the Owner to be waived, except as set forth in paragraph 11.3.

11.1.3.1.1 Each such certificate of insurance shall expressly provide that the insurer will endeavor to provide no less than 30 days’ written notice to the Owner in the event of cancellation of the coverage evidenced by the certificate.

11.1.3.1.2 For each insurance policy required by this Contract, the Contractor shall provide the Owner with 30 days’ prior written notice of cancellation or non-renewal. Failure to comply with these reporting provisions shall constitute grounds for the Owner‘s termination of the Contract for cause pursuant to paragraph 14.2.

11.1.3.2 The Contractor shall furnish the Owner~~,~~ when requested, a certified copy of any insurance or additional insured or loss payee endorsement required to be purchased or maintained by the Contract Documents. In no event shall failure of the Owner to demand a certified copy of any required insurance or endorsement be construed as a waiver of the obligation of the Contractor to obtain required insurance.

11.1.3.3 The Contractor shall maintain insurance in the required amounts, without interruption, from the date of execution of the Contract until the date of approval of the Certificate of Substantial Completion by the Owner. Failure to maintain the required insurance during the time specified shall be cause for termination of the Contract.

11.1.3.4 Insurance policies required to be purchased and maintained by the Contractor may include a reasonable loss deductible, which shall be the responsibility of the Contractor to pay in the event of loss.

11.1.3.5 The prompt repair or reconstruction of the Work resulting from an insured loss or damage is the Contractor's responsibility and shall be accomplished at no additional cost to the Owner.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

Add Section 12.2.2.4 to Section 12.2.2:

12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Substantial Completion, the Architect will conduct, and the Contractor shall attend, a meeting with the Owner to review the facility operations and performance,

ARTICLE 15 CLAIMS AND DISPUTES

Add Sections 15.1.6.3 and 15.1.6.4 to Section 15.1.6:

15.1.6.3 Claims for increase in the Contract: Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require, including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

15.1.6.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

END OF SECTION

SECTION 011000 - SUMMARY

PART 1 GENERAL

1.1 PROJECT

A. Project Name: OAS Misc. Renovation Phase 2 - ADA Soccer Restroom

B. Oscoda Area School's Name: Oscoda Area Schools.

C. Architect's Name: The Collaborative.

D. The Project consists of the construction of two new ADA restrooms and site work to facilitate access to the new restrooms to be performed in the summer of 2026.

1.2 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 005200 - Agreement Form.

1.3 WORK BY OWNER

A. Oscoda Area School will award a contract for the abatement scope which will commence on the determined start date.

B. Items noted NIC (Not in Contract) or OPOI (Owner provided, Owner installed) will be supplied and installed by Oscoda Area School before Date of Substantial Completion.
1. _____.
2. _____.
3. _____.

1.4 OWNER OCCUPANCY

A. Oscoda Area School intends to occupy the Project upon Substantial Completion.

B. Cooperate with Oscoda Area School to minimize conflict and to facilitate Oscoda Area School's operations.

C. Schedule the Work to accommodate Oscoda Area School occupancy.

1.5 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Provide access to and from site as required by law and by Oscoda Area School:
1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Time Restrictions:
   1. Weekend work must be approved in advance in writing by Owner..

D. Utility Outages and Shutdown:
   1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Oscoda Area School and authorities having jurisdiction.
   2. Limit shutdown of utility services to minimum required duration, arranged at least 7 days in advance with Owner
   3. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Document 002113 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

B. Document 004323 - Alternates Form: List of Alternates as supplement to Bid Form.

C. Document 005200 - Agreement Form: Incorporating monetary value of accepted Alternates.

1.2 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Oscoda Area School's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

1.3 SCHEDULE OF ALTERNATES

A. Alternate No. G-1 - OAS Misc. Renovations - Richardson:
   1. Alternate Item: All drawings and specs pertaining to the Richardson School Building

B. Alternate No. G-2 - OAS Misc. Renovations - Athletic Field Restrooms:
   1. Alternate Item: All drawings and specs pertaining to the Athletic Field Restrooms

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.2 RELATED REQUIREMENTS

A. Section 002113 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 012100 - Allowances, for cash allowances affecting this section.

C. Section 012200 - Unit Prices, for additional unit price requirements.

D. Section 013000 - Administrative Requirements: Submittal procedures, coordination.

E. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.3 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

1.4 REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.

B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Oscoda Area School.
5. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

B. Submittal Form (before award of contract):
1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Substitutions will not be considered under one or more of the following circumstances:
1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
2. Without a separate written request.
3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

3.5 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

END OF SECTION

SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Progress photographs.

F. Submittals for review, information, and project closeout.

G. Number of copies of submittals.

H. Requests for Interpretation (RFI) procedures.

I. Submittal procedures.

1.2 RELATED REQUIREMENTS

A. Section 013216 - Construction Progress Schedule: Form, content, and administration of schedules.

B. Section 016000 - Product Requirements: General product requirements.

C. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.3 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.

8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

A. Oscoda Area School will schedule a meeting after Notice of Award.

B. Attendance Required:
1. Oscoda Area School.
2. Architect.
3. Contractor.

C. Agenda:
1. Execution of Oscoda Area School-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
5. Submission of initial Submittal schedule.
6. Designation of personnel representing the parties to Contract.
7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Oscoda Area School, participants, and those affected by decisions made.

3.2 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum weekly intervals.

B. Oscoda Area School will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Oscoda Area School.
3. Contractor's superintendent.
4. Major subcontractors.

D. Agenda:
1. Review minutes of previous meetings.

2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Coordination of projected progress.
12. Maintenance of quality and work standards.
13. Effect of proposed changes on progress schedule and coordination.
14. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Oscoda Area School, participants, and those affected by decisions made.

3.3 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule every 30 days.

3.4 PROGRESS PHOTOGRAPHS

A. Submit new photographs at least once a month, within 3 days after being taken.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

D. In addition to periodic, recurring views, take photographs of each of the following events:
1. Final completion, minimum of ten (10) photos.

E. Views:
1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.

2. Consult with Architect for instructions on views required.
3. Provide factual presentation.
4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
5. Point of View Sketch: Provide sketch identifying point of view of each photograph.

F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.5 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
   a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
   b. Do not forward requests which solely require internal coordination between subcontractors.
2. Prepare in a format and with content acceptable to Architect .
3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
   a. Approval of submittals (use procedures specified elsewhere in this section).
   b. Approval of substitutions (see Section - 016000 - Product Requirements)
   c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
   d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable

response. They will be returned without a response, with an explanatory notation.

3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Discrete and consecutive RFI number, and descriptive subject/title.
   3. Issue date, and requested reply date.
   4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   5. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.

G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Oscoda Area School.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
   2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.

3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.6 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Submit at the same time as the preliminary schedule specified in Section - 013216 - Construction Progress Schedule.
   2. Coordinate with Contractor's construction schedule and schedule of values.
   3. Format schedule to allow tracking of status of submittals throughout duration of construction.
   4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
   5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.7 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.8 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Oscoda Area School.

3.9 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Oscoda Area School's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a single transmittal for related items.
   2. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   3. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   4. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
      b. For sequential reviews involving Architect's consultants, Oscoda Area School, or another affected party, allow an additional 7 days.
      c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.

5. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
6. Provide space for Contractor and Architect review stamps.
7. When revised for resubmission, identify all changes made since previous submission.
8. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
9. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
10. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.12 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will not acknowledge receipt, and take no other action.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Approved", or language with same legal meaning.
b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.

c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
   1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.

2. Not Authorizing fabrication, delivery, and installation:
   a. "Revise and Resubmit".
      1) Resubmit revised item, with review notations acknowledged and incorporated.
      2) Non-responsive resubmittals may be rejected.
   b. "Rejected".
      1) Submit item complying with requirements of Contract Documents.

END OF SECTION

SECTION 013216 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.2 SUBMITTALS

A. Submit updated schedule with each Application for Payment.

1.3 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.2 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules to define critical portions of the entire schedule.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

G. Indicate delivery dates for owner-furnished products.

H. Provide legend for symbols and abbreviations used.

3.3 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.4 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.5 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.6 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Oscoda Area School, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.2 RELATED REQUIREMENTS

A. Section 012100 - Allowances: Allowance for payment of testing services.

B. Section 016000 - Product Requirements: Requirements for material and product quality.

1.3 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2025a.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

1.4 DEFINITIONS

A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
   1. Design Services Types Required:
      a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.

B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.5 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. Temporary foundation underpinning.
   6. Temporary stairs or steps required for construction access only.
   7. Temporary hoist(s) and rigging.
   8. Investigation of soil conditions to support construction equipment.

1.6 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
   1. Concrete Mix Design: As described in Section 033000 - Cast-in-Place Concrete. No specific designer qualifications are required.
   2. Structural Design of Metal Framing: As described in Section 054000 - Cold-Formed Metal Framing.

3. Structural Design of Stairs: As described in Section 055100 - Metal Stairs.
4. Structural Design of Railings: As described in Section 055213 - Pipe and Tube Railings.
5. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 084313 - Aluminum-Framed Storefronts.
6. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to building structure, physical characteristics, resulting dimensional limitations as described in Section 084413 - Glazed Aluminum Curtain Walls.

1.7 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Oscoda Area School's information.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of test/inspection.
      h. Date of test/inspection.
      i. Results of test/inspection.
      j. Compliance with Contract Documents.
      k. When requested by Architect, provide interpretation of results.
   2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Oscoda Area School's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Oscoda Area School's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Oscoda Area School.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.9 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Oscoda Area School will employ and pay for services of an independent testing agency to perform code required testing and inspection.

B. As indicated in individual specification sections, Oscoda Area School or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, ASTM D3740, and _____.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

E. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.

F. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

G. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Oscoda Area School's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.5 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Project identification sign.

H. Field offices.

1.2 RELATED REQUIREMENTS

A. Section 015100 - Temporary Utilities.

B. Section 01 7419 - Construction Waste Management: General requirements and procedures for recycling and disposing of construction waste.

1.3 TEMPORARY UTILITIES - SEE SECTION 015100

A. Oscoda Area School will provide the following:
1. Electrical power and metering, consisting of connection to existing facilities.
2. Water supply, consisting of connection to existing facilities.
3. Contractor will provide connections to existing utilities at location designated by Owner.

1.4 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.5 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.6 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 8 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.7 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.8 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Oscoda Area School-occupied areas, to prevent penetration of dust and moisture into Oscoda Area School-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.9 SECURITY - SEE SECTION 013553

A. Provide security and facilities to protect Work, existing facilities, and Oscoda Area School's operations from unauthorized entry, vandalism, or theft.

1.10 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Oscoda Area School.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.11 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated on drawings.

B. Erect on site at location indicated.

C. No other signs are allowed without Oscoda Area School permission except those required by law.

1.13 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 57 13 - TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the work required to provide and maintain temporary soil erosion and sedimentation control.

1.02 JOB CONDITIONS:

A. Requirements: Comply with Drawings and permit requirements.

B. Permit: Obtain permit from local enforcing agency, if not already obtained.

C. Time Limitations: MDOT 208.03B.

PART 2 - PRODUCTS

2.01 MATERIALS: MDOT 208.02 and as approved by the regulating agency.

PART 3 - EXECUTION

3.01 PERFORMANCE:

A. General: Abide with all applicable rules and regulations as established by the State of Michigan and the local regulating agency in conjunction with Act 451 of 1994, Natural Resources and Environmental Protection Act, Part 91 as amended, Michigan Soil Erosion and Sedimentation Control (formerly PA 347 of 1972, as amended).

B. Sediment Removal:
1. Take such steps as are necessary to assure the retention and removal of any sediment which enters a drainage system along the construction route before said system discharges into a stream, pond or lake.
2. If eroded material is allowed to enter a storm sewer system, all catch basins, manholes, pipe and culverts shall be cleaned following construction prior to receipt of final payment. Unless Contractor can document positively to what extent an existing storm sewer system along the construction area was silted in prior to construction, no credit will be given for cleaning the system.
3. Maintain roadways in a passable condition until paving is completed, including any maintenance and dust control.

C. Construction of Soil Erosion and Sedimentation Control Measures: MDOT 208.03C.
1. Provide and maintain the following temporary soil erosion and sedimentation control measures unless otherwise shown on the Drawings or in the permit:
   a. Excavated or borrow material stockpile:
      1) Place silt fence around stockpile in a manner to prevent soil erosion from entering the drainage system or leaving the site.
   b. Trench backfill in place.
      1) Place silt fence across trenches, ditches and around inlets to prevent soil erosion from leaving the site or entering the drainage system until:
      2) Seed and mulch have been placed in non-paved areas.
      3) Aggregate has been placed in bituminous and gravel areas.

c. Dewatering discharge.
   1) Place bales of hay, straw and/or siltation fencing staked in place at point of discharge, adequately anchored.
d. Grading limits.
   1) Place silt fence along down gradient side of all areas disturbed by grading operations.
e. Catch basins.
   1) Provide inlet protection around catch basin and below grates. Remove after turf is established
f. Culvert inlets.
   1) Place stone check dam and silt fence upstream of all culvert inlets.
g. Drain cleanout.
   1) Excavate sediment basin and place stone check dam at downstream end prior to cleanout operation.

D. Maintenance of Soil Erosion and Sedimentation Control Measures: MDOT 208.03C.

E. Removal of Soil Erosion and Sedimentation Control Measures: MDOT 208.03D.

3.02 SCHEDULES:

A. MDOT Standard Plan R-96-E (6 sheets)

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

B. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

C. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.3 REFERENCE STANDARDS

A. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products; 2022 (Corrigendum 2021).

B. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.

C. ISO 14040 - Environmental Management - Life Cycle Assessment - Principles and Framework; 2006, with Amendment (2020).

D. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines; 2006, with Amendment (2020).

E. ISO 21930 - Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services; 2017.

1.4 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.5 QUALITY ASSURANCE

A. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
   1. Good: Product-specific; compliant with ISO 14044.
   2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
   3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
   4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.

B. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.

C. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the Project site.

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Oscoda Area School; notify Oscoda Area School promptly upon discovery; protect, remove, handle, and store as directed by Oscoda Area School.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Oscoda Area School, or otherwise indicated as to remain the property of the Oscoda Area School, become the property of the Contractor; remove from site.

2.2 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:
1. Made using or containing CFC's or HCFC's.
2. Made of wood from newly cut old growth timber.
3. Containing lead, cadmium, or asbestos.

C. Where other criteria are met, Contractor shall give preference to products that:
1. If used on interior, have lower emissions, as defined in Section 016116.
2. If wet-applied, have lower VOC content, as defined in Section 016116.
3. Are extracted, harvested, and/or manufactured closer to the location of the project.
4. Have longer documented life span under normal use.
5. Have a published Environmental Product Declaration (EPD).
6. Have a published Health Product Declaration (HPD).

2.3 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Products with a Basis of Design listed either in the specifications or in the Drawings: Use the Basis of Design product, or submit a request for substitution for a comparable product meeting the product requirements. Substitutions may be permitted from a list of named manufacturers, or by other manufacturers, depending on the specified product.

2.4 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.2 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.3 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.
   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

F. For exterior storage of fabricated products, place on sloped supports above ground.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 017000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Oscoda Area School personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.2 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 013000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 014000 - Quality Requirements: Testing and inspection procedures.

D. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 015000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 017419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

G. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

H. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

I. Section 078400 - Firestopping.

1.3 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Oscoda Area School or separate Contractor.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.5 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.6 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
   2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Oscoda Area School.

F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
   2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
   3. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

G. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.7 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Oscoda Area School occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Oscoda Area School's activities.

PART 2 PRODUCTS

2.1 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Oscoda Area School, participants, and those affected by decisions made.

3.4 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize recognized engineering survey practices.

H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations.

I. Periodically verify layouts by same means.

J. Maintain a complete and accurate log of control and survey work as it progresses.

3.5 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 .

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.

2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
   b. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.7 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material , to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.8 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.9 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

B. Demonstrate operation and maintenance of products to Oscoda Area School's personnel two weeks prior to date of Substantial Completion.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Execute final cleaning after Substantial Completion but before making final application for payment.
   1. Clean areas to be occupied by Oscoda Area School prior to final completion before Oscoda Area School occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Oscoda Area School.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Oscoda Area School-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Oscoda Area School.

END OF SECTION

SECTION 017800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.2 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.3 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
   1. Provide (1) hard copy of project record documents and an electronic copy

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Oscoda Area School, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Oscoda Area School's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Oscoda Area School.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

3.2 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.4 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

3.5 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Oscoda Area School's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Operation and maintenance data.
      c. Field quality control data.
      d. Photocopies of warranties and bonds.

3.6 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Oscoda Area School's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1 SUMMARY

A. A. Demonstration of products and systems where indicated in specific specification

B. Training of Owner personnel in operation and maintenance is required for:
1. All software-operated systems.
2. HVAC systems and equipment.
3. Plumbing equipment.
4. Electrical systems and equipment.
5. Landscape irrigation.
6. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
2. Exterior masonry.
3. Finishes, including flooring, wall finishes, ceiling finishes.
4. Fixtures and fittings.
5. Items specified in individual product Sections.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
2. Submit one copy to the Commissioning Authority, not to be returned.
3. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

END OF SECTION

SECTION 024100 - DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.2 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.3 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   5. Provide, erect, and maintain temporary barriers and security devices.
   6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   8. Do not close or obstruct roadways or sidewalks without permit.
   9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Oscoda Area School.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Oscoda Area School; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

F. Perform demolition in a manner that maximizes salvage and recycling of materials.
   1. Dismantle existing construction and separate materials.
   2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.2 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Oscoda Area School.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Oscoda Area School.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.3 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 .

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.4 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 033511 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. High-gloss sealer as final floor finish..

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.3 REFERENCE STANDARDS

A. ANSI A326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials; 2021.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with concrete floor placement and concrete floor curing.

B. Preinstallation Meeting:

1. Convene one week before starting work of this Section.

2. Conduct a review of procedures required to produce specified results.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

C. Selection Samples: Provide color samples for Architect selection representative of range of colors within installation.

1. Joint filler material.

D. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 3 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least 3 years of documented experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

B. Store materials to comply with manufacturer’s written instructions to prevent deterioration from moisture or other detrimental effects.

1.8 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS, GENERAL

A. Where multiple products are applied to the same concrete surface, verify compatibility with manufacturers.

B. Where sealed concrete is specified, apply a minimum of two coats of curing and sealing compound at new concrete as specified in Section 033000, or a compatible sealer specified in this Section where only one coat of curing and sealing compound has been applied.

2.2 COATINGS

A. High-Gloss Clear Coating: Transparent, nonyellowing, acrylic-polymer-based coating.

1. Composition: Water-based.

a. Solids Content: 25 percent, minimum, when measured by volume.

b. Acceptable Products:

1) Dayton Superior Corporation; Cure & Seal 25%: www.daytonsuperior.com/#sle.

2) Euclid Chemical Company: SUPER DIAMOND CLEAR VOX: www.euclidchemical.com/#sle.

3) LATICRETE L&M; Dress & Seal WB 25: www.lmcc.com/#sle.

4) W. R. Meadows, Inc.; VOCOMP-25: www.wrmeadows.com.

5) Substitutions: See Section 016000 - Product Requirements.

2.3 RELATED MATERIALS

A. Neutralizing Agent: Tri-sodium phosphate.

B. Joint Filler: Semi-rigid, 2 component, self-leveling, 100% solids polyurea:

1. Durometer Shore A hardness: 80 minimum.

2. Color as selected by Architect from manufacturer's full range.

3. Acceptable Manufacturers:

a. Euclid Chemical.

b. Hi-Tech Systems.

c. Metzger/McGuire.

d. Substitutions: See Section 016000 - Product Requirements.

C. Water: Potable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this Section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

C. Do not proceed until unsatisfactory conditions are corrected.

3.2 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

B. Prepare surfaces as required by finishing system manufacturer.

3.3 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

1. Use application materials, methods, and procedures required by coating manufacturer to establish and maintain specified warranty.

3.4 PROTECTION

A. Protect installed concrete floor finishes from subsequent construction operations.

B. Do not permit traffic over unprotected floor surface.

END OF SECTION 033511

SECTION 042000 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete block.

B. Concrete facing brick.

C. Mortar and grout.

D. Reinforcement and anchorage.

E. Flashings.

F. Lintels.

G. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2025a.

D. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2023.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2025.

F. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

G. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

H. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

I. ASTM C55 - Standard Specification for Dry-Cast Concrete Building Brick; 2025.

J. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.

K. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.

L. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.

M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

N. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025a.

O. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

P. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

Q. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2021.

R. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025a.

S. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

T. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2013.

U. ASTM C1384 - Standard Specification for Admixtures for Masonry Mortars; 2018, with Editorial Revision.

V. ASTM C1611 - Standard Test Method for Slump Flow of Self-Consolidating Concrete; 2021.

W. ASTM C1634 - Standard Specification for Dry-Cast Concrete Facing Brick and Other Concrete Masonry Facing Units; 2025.

X. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.

Y. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.

Z. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

AA. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

BB. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

CC. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting two weeks before starting work of this section; require attendance by all relevant installers.

1. Agenda:

a. Schedule and sequencing.

b. Requirements for testing and special inspections.

c. Hot and cold weather construction procedures.

d. Typical and atypical details.

e. Locations of movement joints.

f. Storage and staging.

g. Temporary bracing.

h. Coordination with other trades.

i. Coordination of foundation dowel locations.

j. Protection of adjacent construction.

k. Compatibility of admixtures.

l. Cleaning procedures.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, mortar, masonry accessories, and reinforcement and anchorage accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, sizes and accessories.

1. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

D. Samples: Submit two samples of each type of decorative masonry unit to illustrate color, texture, and extremes of color range.

E. Samples: Submit two samples of each pigmented mortar color.

F. Mix Designs: For each type of mortar and grout. Include description of types and proportions of ingredients.

G. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1. For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

1.6 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Fire Rated Assemblies: Comply with applicable code for specified requirements for fire rated masonry construction.

1. Fire rated concrete masonry units shall be in compliance when the masonry has been certified through the equivalent thickness method contained in Chapter 3 of ACI 216.1 for concrete masonry and Chapter 5 for effects of finish materials.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store materials and accessories on elevated platforms in dry location. Keep materials covered with weatherproof sheeting secured from wind. Minimize condensation in shrinkage-wrapped pallets of units.

1.8 FIELD CONDITIONS

A. During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress. Extend cover a minimum of 24 inches down both sides of walls and hold securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after constructing masonry walls or columns.

C. Hot and Cold Weather Requirements: Compy with TMS 402/602.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS (CMU)

A. Acceptable Manufacturers:

1. Best Block: www.bestblock.com.
2. Cemex: www.cemexusa.com.
3. Fendt Builder's Supply, Inc.: www.fendtproducts.com.
4. Grand Blanc: www.grandblanccementproducts.com.
5. National Block Company: www.nationalblock.com.
6. Superior Block Co. Inc.: www.superiorblock.com.
7. Substitutions: See Section 01 6000 - Product requirements.

B. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
2. Special Shapes: Provide nonstandard blocks configured for corners, headers, control joint edges, jambs, and other detailed conditions.
    a. Provide bullnose units for outside corners.
3. Load-Bearing Units: ASTM C90, normal weight.
    a. Hollow block, as indicated.
    b. Unit Compressive Strength: 2,000 psi minimum.
    c. Exposed Faces: Manufacturer's standard color and texture.
4. Nonloadbearing Units: ASTM C129.
    a. Hollow block, as indicated.
    b. Normal weight.

C. Concrete Brick:

1. Size: As indicated on drawings.
2. Provide bullnose units for outside corners.

3. Concrete Facing Brick (Exposed to View): ASTM C1634; solid, normal weight; for architectural use.

    a. Exposed Faces:

        1) Texture: Split faced.

        2) Color: As indicated in drawings.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.

1. Blended Hydraulic Cement: ASTM C595/C595M, Type IL or Type IIL, except Type IIIL may be used for cold-weather construction.

2. Cement Color: Color as required to produce approved color sample.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

1. Color(s): As selected by Architect from manufacturer's full range.

2. Manufacturers:

    a. Davis Colors, a division of Venator Materials PLC: www.daviscolors.com/#sle.

    b. Lambert Corporation: www.lambertusa.com/#sle.

    c. Solomon Colors, Inc: www.solomoncolors.com/#sle.

    d. Substitutions: See Section 016000 - Product Requirements.

F. Water: Clean and potable.

G. Admixtures: Comply with ASTM C1384 to enhance set retarding, set accelerating, bond, and workability.

H. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

1. Color: Mineral pigments added as required to produce approved color sample.

I. Packaged Dry Material for Mortar for Unit Masonry: Premixed masonry cement and mason sand; complying with ASTM C1714/C1714M and capable of producing mortar of specified strength in accordance with ASTM C270 with addition of water only.

1. Color: Mineral pigments added as required to produce approved color sample.

J. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

1. Do not use water-repellent materials or admixture or air-entraining admixture when grout will be in contact with reinforcement.

2. Type: Coarse.

2.3 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

B. Single Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Ladder.

2. Material:

a. Interior Walls: ASTM A1064/A1064M steel wire, mill galvanized to 16 CFR 1201 Class 3.

3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

C. Ties and Anchors - General: Provide ties and anchors, hot dip galvanized to ASTM A 153/A 153M, Class B, except as follows.

1. Provide stainless steel ties and anchors in rooms subject to high humidity or wetting.

D. Flexible Anchors for Connecting to Structure: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.

1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick,.

E. Masonry Veneer Anchors for CMU or Concrete Back-up with Continuous Insulation: 2-piece anchors that permit differential movement between masonry veneer and structural backup.

1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners.

2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.

3. Vertical adjustment: Not less than 1-1/4 inches.

4. Acceptable Products:

a. Hohmann & Barnard, Inc.; HB-5213.

b. Blok Lok BL-407 with insulation washers.

c. Wirebond; 2407 Adjustable Veneer Anchor with insulation washers.

d. Wirebond; RJ-711 Adjustable Veneer Anchor.

e. Substitutions: See Section 01 6000 - Product Requirements.

2.4 FLASHINGS

A. Combination Non-Asphaltic Flashing Materials - Stainless Steel:

1. Stainless Steel Flashing - Self-adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner.

a. Manufacturers:

1) Hohmann & Barnard, Inc; Mighty-Flash SA: www.h-b.com/#sle.

2) STS Coatings, Inc; Wall Guardian Self Adhering Stainless Steel Flashing: www.stscoatings.com/#sle.

3) VaproShield, LLC; Vapro-SS-Flashing: www.vaproshield.com/#sle.

4) WIRE-BOND; BOND-N-FLASH S.A.: www.wirebond.com/#sle.

5) York Flashings; York 304: www.yorkflashings.com/#sle.

6) Substitutions: See Section 016000 - Product Requirements.

B. Termination Bars: Stainless steel; compatible with membrane and adhesives.

1. Type: Provide flanged type for continuous sealant along top edge.

C. Drip Edge: Stainless steel; Type 304, 0.0156 inches thick.

1. Type at Lintels, Shelf Angles, and All Locations Except at Grade: Drip edge extending at least 3 inches horizontally into masonry and 1/2 inch out from exterior face of masonry with outer edge bent down 45 degrees and hemmed.

2. Type at Grade: Drip edge extending at least 3 inches horizontally into masonry and outer edge bent 180 degrees flush with face of masonry.

3. Sealant Between Layers of Sheet Metal: One-part, non-skinning butyl sealant.

D. Adhesives, Primers, Sealants, and Seam Tapes for Flexible Membrane Flashing Systems: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.5 ACCESSORIES

A. Preformed Control Joints: Rubber or polyvinyl chloride material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell rubber, neoprene or polyurethane; oversized 50 percent to joint width; self expanding; in maximum lengths available.

1. Complying with ASTM D1056, Grade 2A1.

C. Grout Retainer: Mesh screen, width 1 inch less than masonry unit width. Use at bottom of open bottom unit to retain grout without use of special shaped CMUs and without breaking mortar bond.

D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6 LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMU matching adjacent CMU in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure lintels before handling and installing. Temporarily support build-in-place lintels until cured.

1. Use masonry lintels in concrete masonry unit walls where lintel is exposed, and as specified in Structural Drawings.

2.7 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

1. Masonry below grade and in contact with earth: Type M.

2. Exterior, loadbearing masonry: Type S.

3. Exterior, non-loadbearing masonry: Type S.

4. Masonry Veneers: Type N.

5. Interior, loadbearing masonry: Type S.

6. Interior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

1. Inspect concrete foundations for compliance with tolerances of TMS 602.

2. Verify reinforcing dowels are positioned in accordance with drawings

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare foundation surface for adequate masonry bond.

B. Direct and coordinate placement of metal anchors supplied for installation under other sections.

C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running.

2. Mortar Joints: Concave.

3.5 PLACING AND BONDING

A. Use full-size units without cutting where possible. Where cutting is required, provide clean, sharp, unchipped edges. Allow units to dry before laying. Install cut units with cut surfaces concealed.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Interlock intersections and external corners.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Cut mortar joints flush where wall tile is scheduled and at locations where required by the work of other Sections.

H. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.6 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels, at bottom of walls, and where indicated.

3.7 REINFORCEMENT AND ANCHORAGE - CMU

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center, except as follows.

B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Place continuous reinforcement around corners.

E. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

F. Lap joint reinforcement ends minimum 12 inches.

G. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

H. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 24 inches horizontally and 16 inches vertically.

I. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.8 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 2 inches, minimum, to form watertight pan at nonmasonry construction.

a. Remove or cover protrusions or sharp edges that could puncture flashings.

b. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing and extending minimum 6 inches above top of cavity drainage material:

1. Install vertical leg of flashing over air and water-resistive barriers oper manufacturer’s directions.

2. Roll laps in self-adhering flashing, leaving no fish-mouths, and apply manufacturer’s mastic at exposed cut edges.

3. Anchor vertical leg of flashing into backing with a termination bar and continous sealant along top edge.

4. Extend self-adhering flashings to within 3/4 inch of exterior face of masonry and adhere to top of stainless steel drip edge.

C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

D. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound.

3.9 LINTELS

A. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

1. Place reinforcing as indicated on drawings.

2. Do not splice reinforcing bars.

3. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

4. Place and consolidate grout fill without displacing reinforcing.

5. Allow masonry lintels to attain specified strength before removing temporary supports.

B. Maintain minimum 8 inch bearing on each side of opening.

3.10 GROUTED COMPONENTS

A. Comply with consolidation requirements and grout pour height and grout lift height limitations of TMS 602.

B. Reinforce bond beams as indicated on drawings.

C. Lap splices minimum 24 bar diameters.

D. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

E. Place and consolidate grout fill without displacing reinforcing.

F. Grout solid all hollow concrete unit masonry located below grade and at other locations indicated.

G. At bearing locations, fill masonry cores with grout for a minimum 8 inches either side of opening.

3.11 CONTROL AND EXPANSION JOINTS

A. Size as indicated on Drawings; if not shown, 3/8 inch wide.

B. Do not continue horizontal joint reinforcement through control joints.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. If control joint locations are not indicated on drawings, locate control joints in CMU walls complying with the NCMA TEK note recommendations and at wall height changes; within ten feet of corners; at wall thickness changes; at bond beam breaks; at abutments of columns and walls; at abutment of cold garages to warm basements or walls; at openings in walls such as doors and windows; and at intervals in continuous walls not exceeding 20 feet in length, unless more restrictive spacing is recommended in the NCMA TEK notes.

3.12 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.13 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Alignment of Columns: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/8 inch, plus 1/8 inch.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow testing agencies and inspectors access to work areas as needed. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

1. See Structural Drawings for additional requirements.

B. Grout: Compressive strength tests per ASTM C1019. Form grout specimens using units used for this project. Do not use cardboard forms unless written approval is obtained based on comparative preconstruction testing performed with units used for this project.

C. Self-Consolidating Grout: Compressive strength tests per ASTM C1019 and slump flow and visual stability index (VSI) per ASTM C1611.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, Annex 4.

3.16 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean masonry using materials approved in Masonry Cleaning Plan. Use cleaning procedures so as not to damage masonry surfaces and consistent with the quality standards established in an approved mock-up or on an inconspicuous area of new masonry as determined by Architect.

D. Use non-metallic tools in cleaning operations.

3.17 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

B. Protect sills, ledges, and projections from mortar droppings. Protect base of wall from mortar and mud splashes.

C. Replace damaged and defective work at no cost to Owner.

END OF SECTION 042000

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation at perimeter foundation wall and exterior wall behind indicated wall cladding systems.

B. Foam insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

C. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.4 QUALITY ASSURANCE

A. Thicknesses specified are for the thermal conductivity (k-value at 75 degrees F) specified for each material. Provide adjusted thicknesses for approved use of substituted materials with different thermal conductivity ratings. Where insulation is specified to have a specific "R" value, furnish manufacturer's standard thickness required to equal or exceed the specified value.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

B. Protect plastic insulation from exposure to direct sunlight.

C. Do not deliver plastic insulation materials to the project site ahead of time of installation. Protect at all times against ignition. Complete the installation and concealment of plastic materials as soon as possible in each area of work.

1.6 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

B. Continuous Wall Insulation: Extruded polystyrene (XPS) board.

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.

1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.

2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.

4. Complies with fire resistance requirements specified as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

5. Board Thickness: As indicated on Drawings.

6. Board Edges: Square.

7. Water Absorption for Insulation Materials in Ground Contact: Type IV, 0.3 percent by volume, maximum, by total immersion, when tested in accordance with ASTM C272.

8. Acceptable Manufacturers:

a. Dow Chemical Company; STYROFOAM Extruded Polystyrene Insulation (XPS): www.dow.com/#sle.

b. Kingspan Insulation LLC; GreenGuard GG25-LG XPS Insulation Board: www.kingspan.com/#sle.

c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.

d. Substitutions: See Section 016000 - Product Requirements.

2.3 ACCESSORIES

A. Insulation Fasteners: Appropriate for purpose intendedand approved by insulation manufacturer.

1. Length as required for thickness of insulation material and penetration of structural backing or framing as indicated, with metal or plastic washers.

2. Acceptable Manufacturers:

a. Hilti: www.hilti.com.

b. Trufast: www.trufast.com.

c. McMaster-Carr: www.mcmaster.com.

B. Sprayed Polyurethane Foam Sealant for Miscellaneous Voids: 1- or 2-component, closed cell, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less when tested per ASTM E 84; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

C. Adhesive: Type recommended by insulation manufacturer for indicated applications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, or irregularities.

3.2 INSTALLATION, GENERAL

A. Install insulation to maintain continuity of thermal protection to building elements and spaces.

3.3 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards as indicated on foundation perimeter.

1. Place boards to maximize adhesive contact.

2. Install in running bond pattern.

3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.

1. Install boards horizontally from base of foundation to top of insulation.

2. Butt boards tightly, with joints staggered from insulation joints.

3.4 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install corrosion resistant impaling pins or other mechanical insulation retention devices, minimum 6 per board or as otherwise recommended by insulation manufacturer, in accordance with insulation manufacturer's written recommendations.

B. Exterior Walls Behind Veneers and Claddings: Install boards tight to substrate without gaps between boards on walls.

1. Install in running bond pattern.

2. Butt edges and ends tightly to adjacent boards and protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Insulation Behind Masonry Veneer: See Section 042000 - Unit Masonry for veneer anchors.

3.5 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 072100

SECTION 072213 - NAILBASE INSULATION PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nailbase insulation panels.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of process and factory-fabricated product.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a company that regularly manufactures polyisocyanurate and fully assembled nailbase insulation panels in-house with no outside fabrication operations.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Transport and store products in accordance with the manufacturer recommendations.

B. Store product on a solid flat foundation and elevate a minimum of 4 inches above the finished surface.

C. Protect insulation from open flame and keep dry at all times.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Carlisle Coatings & Waterproofing, Inc.; R2+ Base.
2. Hunter Panels; Xci Ply.
3. Laminators Inc., Omega CI.
4. GAF Cornell Corporation; ThermaCal.
5. Atlas Roofing Corporation; ACFoam Nail Base.
6. Substitutions: See Section 016000 - Product Requirements.

2.2 NAILBASE INSULATI

A. Nailbase Insulation Panels: Wood construction panel laminated to polyisocyanurate insulation board.

1. Total R-Value: R-30.
2. Construction Panel: Either DOC PS 1 or DOC PS 2, 7/16 inch (11 mm) oriented strand board (OSB).
3. Insulation Board: Polyisocyanurate foam plastic, ASTM C1289, Type V, with cellulosic felt facer or glass fiber mat facer on major surface opposite construction panel.

2.3 FASTENERS

A. Fasteners: Provide manufacturer's recommended type and length.

1. Provide non-corrosive fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Minimum Deck Pentration: As required by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify deck, adjacent materials, and structural backing is dry and ready to receive insulation.

C. Verify deck surface is flat, free of fins, protrusions and irregularities.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit tight to vertical obstructions and penetrations.

D. Exposed insulation must be protected from open flame and kept dry at all times.

E. Fasten composite insulation securely to the structural base. Contact nailbase insulation manufacturer for fastening pattern requirements.

F. Only install enough material per day that can be covered the same day by a completed roof covering material.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Cover the top and edges of unfinished roof panel work to protect it from the weather and to prevent accumulation of water in the cores of the panels.

END OF SECTION 072213

SECTION 072726 - FLUID-APPLIED AIR BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fluid-applied air barriers.

1.2 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air impermeable with water vapor permeance as specified, having sealed seams and sealed joints to adjacent surfaces.

1.3 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D751 - Standard Test Methods for Coated Fabrics; 2019.

C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2025).

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

G. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation with adjacent flashings and weather barriers for compatibility and continuity of those systems.

2. Coordinate installation of flashings at openings with Sections that specify window, door, and other opening installations.

3. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

B. Preinstallation Meeting: Conduct a preinstallation meeting at least two weeks prior to the start of the work of this Section.

1. Agenda shall include quality standards set by approved mock-up, sequence of construction, coordination with substrate preparation, air barrier materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction.

2. Attendance is required by Contractor, Architect, Installer, and representatives of related trades including covering materials, substrate materials and adjacent materials.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, limitations, and manufacturer's standard flashing and termination details.

C. Shop Drawings: Provide drawings of project-specific flashing, termination, and special joint conditions based on manufacturer's standard details; minimum scale 1-1/2 inch equals 1 foot.

D. Compatibility: Submit letter from primary material manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use.

E. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

B. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. System Compatibility: Confirm that selected weather barrier system components are compatible with each other as as system and are also compatible with substrate surfaces, opening materials, other adjacent flashings and weather barrier materials, and joint sealants.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle materials in accordance with material manufacturer’s recommendations.

1.8 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

B. Do not install air barrier in snow, rain, fog, or mist. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

1.9 WARRANTY

A. Material Warranty: Provide material manufacturer’s standard product warranty, for a minimum five years from date of Substantial Completion.

B. Installation Warranty: Provide a two (2) year installation warranty from date of Substantial Completion, including all accessories and materials of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of adhesion and failure to cure properly.

PART 2 PRODUCTS

2.1 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR IMPERMEABLE)

A. Fluid Applied Air and Vapor Barrier:

1. Dry Film Thickness (DFT): As recommended by manufacturer for each substrate, having a minimum thickness of 25 mil, 0.025 inch.

2. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.

3. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.

4. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M.

5. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.

6. Elongation: 250 percent, minimum, when tested in accordance with ASTM D412.

7. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.

8. Complies with NFPA 285 requirements for wall assembly.

9. Seam and Perimeter Tape: As recommended by sheet manufacturer.

10. Acceptable Products:

    a. Carlisle Coatings and Waterproofing, Inc; Fire Resist Barritech NP: www.carlisleccw.com/#sle.

    b. GCP Applied Technologies; Perm-A-Barrier NPL 10: www.gcpat.com/#sle.

    c. Henry Company; Air-Bloc 16MR: www.henry.com.

    d. Polyglass; VertiWrap NPL: www.polyglass.com.

    e. Tremco Commercial Sealants & Waterproofing; ExoAir 130: www.tremcosealants.com/#sle.

    f. W.R. Meadows, Inc.; Air-Shield LSR: www.wrmeadows.com.

    g. Substitutions: See Section 016000 - Product Requirements.

2.2 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions, and as required for a complete and air-tight installation.

1. All accessory materials shall have air and water vapor permeance performance matching that of the primary air barrier system.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.

1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch, nominal thickness.

2. Elongation: 400 percent, minimum, measured in accordance with ASTM D412.

3. Peel Adhesion: 28 lb/inch, minimum, when tested in accordance with ASTM D903.

4. Hydrostatic Head Pressure: Resists head pressure of 57 feet, maximum, when tested in accordance with ASTM D751.

5. Comply with NFPA 285 requirements for wall assembly.

C. Primer: As recommended by primary air barrier membrane manufacturer.

D. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement waived if not installed on roof.

1. Thickness: 40 mil, 0.040 inch, nominal; exception from ASTM D1970/D1970M.

2. Width: 4 inches, minimum.

3. Water Vapor Permeance: Matching that of primary air barrier, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.

E. Stainless Steel Flashing: Flexible flashing with 2 mil, 0.002 inch thick Type 304 stainless steel sheet, 8 mil, 0.008 inch of butyl adhesive and siliconized release liner.

1. Width: 6 inches wide, minimum.

2. Overlap joints at least 2 inches.

3. Products:

a. Hohmann & Barnard, Inc.; Mighty-Flash SA Stainless Flashing: www.h-b.com.

b. Momentive Performance Materials, Inc/GE Silicones; GE Elemax SS Flashing: www.siliconeforbuilding.com/#sle.

c. STS Coatings, Inc; Wall Guardian Self Adhering Stainless Steel Flashing: www.stscoatings.com/#sle.

d. VaproShield, LLC; VAPRO-SS FLASHING: www.vaproshield.com/#sle.

e. York Manufacturing, Inc; York 304 SA: www.yorkmfg.com/#sle.

f. Substitutions: See Section 016000 - Product Requirements.

F. Liquid Flashing: One part, fast curing, nonsag, elastomeric, gun grade, trowelable.

G. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Ensure that the following conditions are met:

1. Surfaces are sound, dry, even, and free of excess mortar or other contaminants.

2. Inspect substrates to be smooth without large voids or sharp protrusions.

C. Verify substrate is visibly dry and free of moisture.

D. Verify sealants are compatible with membrane proposed for use.

E. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

F. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives, sealants, and air barrier materials in accordance with manufacturer's installation instructions.

C. Protection from spray-applied materials:

1. Mask and cover adjacent areas to protect from over-spray.

2. Ensure any required foam stop or back up materials are in place to prevent over-spray and achieve complete seal.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Refer to air barrier manufacturer's detail drawings for installation procedures including:

1. Changes in substrate.

2. Control joints.

3. Crack treatments.

4. Inside and outside corners.

5. Penetrations.

6. Rough openings.

7. Sheathing joints.

3.4 PROTECTION

A. Protect air barrier materials from damage during installation and the remainder of the construction period, according to material manufacturer's written instructions.

B. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 072726

SECTION 074113 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal roof panel system of preformed steel panels.

1.2 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

E. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2016a (Reapproved 2021).

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

G. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2025.

H. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate installation of waterproof membrane over roof sheathing.

2. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work for a complete, waterproof assembly.

B. Preinstallation Meeting: Convene one week before starting work of this Section.

1. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.

2. Review flashings, special details, drainage, penetrations, curbs, and conditions of other construction that affect metal panels.

3. Review temporary protection requirements for metal panel systems during and after installation.

4. Review procedures for repair of metal panels damaged after installation.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Summary of test results, indicating compliance with specified requirements.

2. Storage and handling requirements and recommendations.

3. Installation methods.

4. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.

1. Show work to be field-fabricated or field-assembled.

2. Indicate substrates and adjacent work with which the system must be coordinated.

3. Include large-scale details or isometric diagrams to fully explain flashing at a scale of not less than 1-1/2 inches per 12 inches.

D. Selection Samples: For each roofing system specified, submit at least 5 color chips representing Architect's designated color range.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.7 FIELD CONDITIONS

A. Do not install metal roof panels, eave protection membrane or underlayment when surface or ambient air temperatures are below 45 degrees F.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 30-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. PAC CLAD; Tite Loc Plus.

B. Other Acceptable Manufacturers:

1. ATAS International, Inc.: www.atas.com/sle.

2. Berridge Manufacturing Company: www.berridge.com/#sle.

3. Centria: www.centria.com.

4. Englert, Inc: www.englertinc.com/#sle.

5. Metal Sales Manufacturing Corporation: www.metalsales.us.com.

6. Morin Corporation: www.morincorp.com/#sle.

7. Substitutions: See Section 016000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:

1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.

   a. Dead Loads: Weight of roofing system.

   b. Live Loads: As required by ASCE 7.

2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.

3. Wind Uplift: Class 90 wind uplift resistance of UL 580.

4. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.3 METAL ROOF PANELS

A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.

1. Steel Panels:

   a. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 galvanizing.

   b. Steel Thickness: Minimum 24 gauge, 0.024 inch.

2. Profile: Standing seam, with minimum 2-inch seam height; concealed fastener system for field seaming with special tool.

3. Texture: Smooth, with intermediate ribs for added stiffness.

4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.

5. Width: Maximum panel coverage of 12 inches.

6. Color: As selected by Architect from manufacturer's standard range of options.

2.4 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips and shims designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.5 FABRICATION

A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

C. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.

D. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before manufacturer fabrication.

2.6 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as indicated.

1. Products:

    a. Arkema, Inc; Kynar 500: www.arkema.com/#sle.

    b. PPG; Duranar: www.ppgmetalcoatings.com/#sle.

    c. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.

    d. Substitutions: See Section 016000 - Product Requirements.

2.7 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

1. See Section 076200 for additional requirements.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish.

C. Sealants: Elastomeric type containing no oil or asphalt.

1. Seam Sealant: Factory-applied, non-skinning, non-drying type.

2. Color: To match metal panel color where exposed.

D. Underlayment: Self-adhering polymer modified asphalt sheet complying with ASTM D1970/D1970M, with strippable release film and top surface of woven polypropylene sheet.

1. Sheet Thickness: 22 mils, 0.022 inch, minimum.

2. Self Sealability: Nail sealability in accordance with ASTM D1970/D1970M.

3. Low Temperature Flexibility: Comply with ASTM D1970/D1970M.

4. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method (Method A).

5. Functional Temperature Range: Minus 45 degrees F to 250 degrees F.

6. Acceptable Products:

a. Carlisle; WIP 300HT.

b. Certainteed Roofing; WinterGuard HT - High Temperature Waterproofing Underlayment: www.certainteed.com/#sle.

c. GCP; Ice & Water Shield HT: www.gcpat.com.

d. Henry Company; Blueskin PE200HT: www.henry.com/#sle.

e. Polyglass USA, Inc; Polystick MTS Self-Adhered High Temperature Roof Underlayment: www.polyglass.us/#sle.

f. Polyguard Products, Inc.; Deck Guard HT: www.polyguard.com.

g. Protecto Wrap Company; Protecto Jiffy Seal Ice and Water Guard HT: www.protectowrap.com/#sle.

h. Substitutions: See Section 016000 - Product Requirements.

E. Fasteners: Manufacturer's recommended stainless steel fasteners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Broom clean substrate prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.

C. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

E. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.

1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.

2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Install specified underlayment on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel and underlayment manufacturer. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches unless otherwise specified by underlayment manufacturer.

D. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

3. Install weathertight escutcheons for pipe- and conduit-penetrating panels.

4. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by panel manufacturer.

5. Provide sealant tape or other approved joint sealer at lapped panel joints.

6. Install sealant or sealant tape at end laps and side joints as recommended by metal roof panel manufacturer.

E. Flashing and Trim: Comply with 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 will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof 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 with no joints allowed within 24 inches of corner or intersection. Where lapped 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 deep, filled with mastic sealant (concealed within joints).

3.4 TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.6 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION 074113

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.

B. Sealants for joints within sheet metal fabrications.

C. Precast concrete splash pads.

1.2 REFERENCE STANDARDS

A. ASTM B32 - Standard Specification for Solder Metal; 2020.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

C. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2025.

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2024).

E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate with roofing work for scheduling installation of counterflashing, rain drainage and similar items related to roofing.

2. 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.

3. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

4. Coordinate with the work of Section 079200 for installation of related sealants.

B. Preinstallation Meeting: Convene one week before starting work of this Section.

1. Require attendance of parties directly concerned with the work of this Section, including those who are required to coordinate with the work, and those who are required to protect the work upon completion.

2. Review preparation and installation procedures and coordinating and scheduling required with related work.

C. Sequencing: Do not proceed with installation of flashing and sheet metal work until substrate construction, cants, blocking, reglets, and other construction are ready to receive the work of this Section.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1. Include identification of material, thickness, weight, and finish for each item and location in Project.

2. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.

3. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.

4. Include details of connections to adjoining work.

5. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

D. Samples: Submit two samples 6 x 6 inch in size illustrating each metal finish color.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.

B. Maintain one copy of each document on site.

C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

C. 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.

1.7 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion. Defective work includes failure of watertightness or seals.

B. Provide 20 year manufacturer warranty for prefinished sheet metal materials. Warranty shall include degradation of metal finish.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet Metal Assemblies:

1. Capable of withstanding structural movement and exposure to wind and weather without failure or permanent deformation.

    a. Design Pressure: Conforming with ASCE 7 or as indicated on structural drawings, whichever is most restrictive.

2. Physically protect building elements and systems from damage that would permit water leakage into building enclosure assemblies under all weather conditions.

B. Sheet Metal Standards: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum gage as scheduled, shop pre-coated with PVDF coating.

1. Exposed Coating: PVDF (Polyvinylidene Fluoride) Superior Performance Organic Finish, AAMA 621; multiple coat, thermally cured fluoropolymer finish system.

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 minimum total dry film thickness of 0.5 mil.

B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M), minimum gage as scheduled; shop pre-coated with with PVDF coating.

1. Exposed Coating: PVDF (Polyvinylidene Fluoride) Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.

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 minimum total dry film thickness of 0.5 mil.

C. Stainless Steel: ASTM A240, Type 304 alloy, soft temper, fully annealed, minimum gage and finish as scheduled.

1. Finish: 2D (dull, cold rolled).

2.3 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats and starter strips of same material as sheet, minimum 12 inches wide, one gage thickness heavier than exposed sheet, and interlocking with exposed sheet.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

E. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.4 SEAMS AND JOINTS

A. Sealant Joints: Where movable, expansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

B. Non-Moving Seams:

1. For metal greater than 0.040 inch thick, fabricate with butt seams with backup plates, fastened one side (SMACNA Figure 3-3, Type 19); seal with butyl sealant concealed within joint.

2. For metals 0.040 inch thick or less, fabricate with flat-lock seams (SMACNA Figure 3-2, Type 2); treat as follows:

a. Prepainted Steel and Aluminum: Form seams and seal with elastomeric sealant. Rivet joints where necessary for strength.

b. Unpainted Aluminum (includes mill finish and anodized: Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

c. Other Metals: Tin edges to be seamed, form seams, and solder.

C. Moving Seams:

1. For metal greater than 0.040 inch thick: Form expansion joints of butt seams with backup plates fastened to substrate (SMACNA Figure 3-3, Type 18) with no fasteners exposed through covers. Seal seams with butyl sealant concealed within joints.

2. For metal 0.040 inch thick or less: Form expansion joints of intermeshing hooked flanges (SMACNA Figure 3-2, Type 1), not less than 1 inch deep, filled with butyl sealant concealed within joint.

D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.

1. Do not solder prepainted metal sheet.

2.5 ROOF SHEET METAL FABRICATIONS

A. Counterflashings: Factory fabricated and finished sheet metal that overlaps top edges of base flashing by at least 4 inches, and designed to snap into thru-wall flashing or reglets with lapped joints. Provide spring action pressure at bottom edge against base flashings.

1. Type and Finish: See Sheet Metal Schedule.

B. Flashings for Metal Roofs: Fabricate miscellaneous metal flashings according to the following SMACNA (ASMM) details or as recommended by roofing manufacturer:

1. Roof Panel Penetrations with Crickets: Figure 8-3 (pipes and vents).

2. Curb Flashings: Figure 8-3.

3. Ridge Caps: Figure 6-17.

4. Ridge, Rake, and Valley Flashings: Figure 6-7.

5. Eave, Hip, and Cap Flashings: Figure 6-6.

2.6 WALL SHEET METAL FABRICATIONS

A. Openings Flashing: Fabricate head, sill, jamb and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high end dams.

1. Type and Finish: See Sheet Metal Schedule.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Gutters and Downspouts: Form to profiles and sizes indicated and as required to properly collect and remove water. Fabricate complete with required connection pieces and strap anchors to maintain watertight joints.

B. Gutters: SMACNA (ASMM) Rectangular profile.

1. Comply with SMACNA (ASMM) Figure 1-12.

C. Downspouts: Rectangular profile.

1. Downspouts: Comply with SMACNA (ASMM) Figures 1-32.

D. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).

E. Accessories: Profiled to suit downspouts.

1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.

2. Gutter Supports: Brackets.

3. Downspout Supports: Brackets.

F. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

G. Seal metal joints.

2.8 ACCESSORIES

A. Fasteners: Non-corrosive type.

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.

c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

3. Fasteners for Zinc-Coated (Galvanized) and Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

B. Underlayment: ASTM D226/D226M, organic roofing felt, Type I (No. 15).

C. Synthetic Underlayment: Polyethylene or polypropylene sheet.

D. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip- resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.

1. Thermal Stability: Stable after testing at 220 deg F; ASTM D 1970.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

3. Acceptable Products:

a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.

b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.

c. Henry Company; Blueskin PE200 HT.

d. Metal-Fab Manufacturing, LLC; MetShield.

e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

f. Polyguard Products, Inc.; Deck Guard HT.

g. Substitutions: See Section 016000 - Product Requirements.

E. Slip Sheet: Rosin sized building paper, 3 lb/100 sq. ft.minimum.

F. Primer: Zinc chromate type.

G. Protective Backing Paint: Zinc molybdate alkyd.

H. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 15 mil dry film thickness per coat.

I. Concealed Sealants: Non-curing butyl sealant.

J. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

K. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

L. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

M. Plastic Cement: ASTM D4586/D4586M, Type I.

N. Solder: ASTM B32; Provide type as described:

1. For Stainless Steel: Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.

2. For Zinc-Coated (Galvanized) Steel: Maximum lead content of 0.2 percent.

2.9 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior performance organic finish with minimum 70 percent PVDF fluoropolymer resin by weight, multiple coat, thermally cured finish system.

1. Acceptable Products:

a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.

b. Sherwin-Williams Company; SHER-NAR 5000: oem.sherwin-williams.com/#sle.

c. Valspar; Fluropon: www.valsparcoilextrusion.com/#sle.

d. Arkema; Kynar 500: www.americas.kynar.com.

e. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

C. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions 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.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

3.3 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

1. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.

1. Do not use plastic underlayment where metals will be site soldered or where plastic sheet will be in direct contact with metal sheets exposed to solar daytime heating.

C. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.4 INSTALLATION - GENERAL

A. Comply with SMACNA Architectural Sheet Metal Manual.

B. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.

4. Torch cutting of sheet metal flashing and trim is not permitted.

5. Do not use graphite pencils to mark metal surfaces.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where concealed flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Coat concealed surfaces of aluminum downspout that come into contact with dissimilar metals with two coats of clear lacquer.

3. Underlayment: Where installing metal directly on cementitious or wood substrates, install underlayment.

D. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

E. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance, but in no case less than 1-1/4 inches for nails and 3/4 inch for wood screws in wood blocking or sheathing.

F. 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.

G. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel and aluminum sheet.

2. Do not use torches for soldering.

3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

I. Rivets: Rivet joints where necessary for strength.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Recessed Reglet Flashings and Counterflashings: Insert flashings full depth into recessed reglet. Anchor by mechanical means, including driven wedges of lead or other compatible metal spaced at 12 inches on center. Seal joint with elastomeric sealant specified in Section 079200.

C. Surface Mounted Reglet Flashings and Counterflashings: Place surface mounted reglet not less than 9 inches above top of cant strip. Place sealant in preformed groove on back of reglet and on lap before installation. Secure reglet to wall with power driven pins through neoprene washers spaced not less than 16 inches on center. Fill top groove with elastomeric sealant specified in Section 079200. After roofing is installed, install snap-lock counterflashing.

1. Lap counterflashing end joints minimum 3 inches. Do not solder joints. Provide continuous counterflashings at angles and corners, and lap over roof base flashings minimum 4 inches, unless detailed otherwise.

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Seal metal joints watertight.

G. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 INSTALLATION - WALL FLASHINGS

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to 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 beyond wall openings.

3.7 INSTALLATION - GUTTERS AND DOWNSPOUTS

A. Install as recommended by SMACNA (ASMM). Join lengths with formed seams sealed watertight.

B. Slope gutters minimum 1/8 inch per foot.

C. Secure downspouts to wall with steel straps or concealed clamp supports, spaced not more than 8 feet oc. Fasten straps or clamps to building with non-corrosive expansion screws.

D. Set splash pad under each downspout, unless othwewise indicated to connect to underground drainage system.

3.8 INSTALLATION - PRE-FINISHED SHEET METAL

A. Take special care in the handling and installation to avoid damage to finish.

B. Remove protective film from each unit after installation, but not before adjacent construction is complete.

C. Touch up minor damage or defects to match factory finish. Replace units which are excessively damaged as determined by Architect.

3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.10 SCHEDULE

A. General:

1. Where more than one metal material is scheduled, provide sheet metal as indicated on Drawings or, if not indicated, to match metal material of adjacent wall or roof material.

2. Unless otherwise indicated in drawings, where flashings are adjacent to metal wall and roof panel systems or aluminum glazing system frames, match adjacent metal finish and color.

3. Counterflashing and flashing receivers used in conjunction with premanufactured roof edge flashings shall be premanufactured by manufacturer of roof edge flashings. Other counterflashing and flashing receivers may be either premanufactured or shop fabricated.

4. Thicknesses shown are minimums. Increase thicknesses as required to comply with SPRI testing requirements and SMACNA recommendations and to meet performance requirements.

5. Visible is defined as "able to be seen from normal public areas." Provide factory finished materials in visible locations unless otherwise indicated.

B. Counterflashings, Visible:

1. Prefinished Galvanized Steel: 0.0217 inch.

2. Finish: PVDF

C. Counterflashings, Concealed:

1. Stainless Steel: 0.0187 inch.
2. Finish: 2D dull annealed.

D. Flashing Receivers, Visible:

1. Prefinished Galvanized Steel: 0.0217 inch.
2. Finish: PVDF

E. Flashing Receivers, Concealed:

1. Stainless Steel: 0.0187 inch.
2. Finish: 2D dull annealed.

F. Hanging Gutters with Girth up to 15 inches:

1. Aluminum: 0.032 inch.
2. Finish: PVDF

G. Downspouts:

1. Aluminum: 0.032 inch.
2. Finish: PVDF

H. Miscellaneous Sheet Metal Fabrications, Trims, Flashings, and Top of Wall Closures, Visible:

1. Aluminum: 0.040 inch thick.
2. Prefinished Galvanized Sheet Steel: 0.0276 inch.
3. Finish: PVDF

I. Openings Flashing in Frame Construction, Visible:

1. Aluminum: 0.025 inch thick.
2. Prefinished Galvanized Sheet Steel: 0.0217 inch.
3. Finish: PVDF

J. Openings Flashing in Frame Construction, Concealed:

1. Stainless Steel: 0.0156 inch.
2. Finish: 2D dull annealed.

K. Masonry Drip Edges:

1. As specified in Section 04 20 00 - Unit Masonry.
2. Stainless Steel: 0.0156 inch
3. Finish: 2D dull annealed.

END OF SECTION 076200

SECTION 079200 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

F. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.

3. Backing material recommended by sealant manufacturer.

4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

5. Substrates the product should not be used on.

6. Substrates for which use of primer is required.

7. Substrates for which laboratory adhesion and/or compatibility testing is required.

8. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

9. Sample product warranty.

10. Certification by manufacturer indicating that product complies with specification requirements.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. 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 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

PART 2 PRODUCTS

2.1 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints:

a. Seal open joints except open joints indicated on drawings as not to be sealed, including, but not limited to, the following:

1) Wall expansion and control joints.

2) Joints between doors, windows, and other frames or adjacent construction.

3) Joints between different exposed materials.

4) Weather sealing joints identified in manufacturer's standard details.

2. Interior Joints:

a. Do not seal interior joints indicated on drawings as not sealed.

b. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.

c. Seal open joints except open joints indicated on drawings as not to be sealed, including, but not limited to, the following:

1) Joints between plumbing fixtures and adjacent construction.

2) Joints between door frames and window frames and adjacent construction.

3. Do Not Seal:

a. Intentional weep holes in masonry.

b. Joints indicated to be covered with expansion joint cover assemblies.

c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.

d. Joints where sealant installation is specified in other sections.

e. Joints between suspended ceilings and walls.

B. Type S - Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.

1. Type B - Bedding sealant at thresholds and sills: Butyl rubber.

2. Type Bn - Lap Joints in Sheet Metal Fabrications: Butyl rubber, noncuring.

3. Type Bn - Lap Joints between Manufactured Metal Panels: Butyl rubber, noncuring.

4. Type Psl - Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane sealant.

C. Type P - Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

1. Type L - Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.

2. Type Sm - Joints between plumbing fixtures and adjoining walls, floors, and counters: Mildew-resistant silicone sealant.

3. Type Sm - Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant.

4. Type Esr - Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.

5. Type Psl - Other Floor Joints: Self-leveling polyurethane traffic-grade sealant.

D. Definitions:

1. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.2 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

B. Colors for Concealed Locations: Manufacturer's standard.

C. Colors for Locations Exposed to View: As selected by Architect from Manufacturer's Full Range.

D. Custom Color-Matched Colors: Where indicated.

2.3 NONSAG JOINT SEALANTS

A. Type S - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.

2. Non-Staining To Porous Materials: Non-staining to light-colored natural stone, masonry, and marble when tested in accordance with ASTM C1248.

3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

4. Color: To be selected by Architect from manufacturer's full range.

5. Products:

    a. Dow; DOWSIL 790 Silicone Building Sealant: www.dow.com/#sle.

    b. Momentive Performance Materials, Inc/GE Silicones; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant: www.siliconeforbuilding.com/#sle.

    c. Pecora Corporation; Pecora 864 NST (Non-Staining Technology): www.pecora.com/#sle.

    d. Sika Corporation; Sikasil WS-295: www.usa.sika.com/#sle.

    e. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.

    f. Substitutions: See Section 016000 - Product Requirements.

B. Type Sm - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

1. Color: To be selected by Architect from manufacturer's standard range.

2. Products:

    a. Momentive Performance Materials, Inc/GE Silicones; SCS1700 Sanitary Sealant: www.siliconeforbuilding.com.

    b. Pecora Corporation; 860: www.pecora.com.

    c. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.

    d. Dow Corning Corporation; 786-M.

    e. Tremco Incorporated; Tremsil 200.

C. Type P - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.

2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.

3. Color: To be selected by Architect from manufacturer's standard range.

4. Service Temperature Range: Minus 40 to 180 degrees F.

5. Products:

a. Pecora Corporation; Dynatrol I-XL: www.pecora.com.

b. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.

c. Tremco Incorporated; Dymonic FC.

D. Type L - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

1. Color: To be selected by Architect from manufacturer's standard range.

2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

3. Products:

a. Momentive Performance Materials, Inc/GE
Silicones; RCS20 Acoustical Latex Sealant: www.siliconeforbuilding.com.

b. Pecora Corporation; AC-20+: www.pecora.com.

c. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.

d. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.

e. BASF Building Systems; Sonolac.

E. Type B - Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.

1. Service Temperature Range: Minus 13 to 180 degrees F.

2. Products:

a. Sherwin-Williams Company; Storm Blaster All Season Sealant: www.sherwin-williams.com/#sle.

b. Pecora Corporation; BC-158.

c. Tremco Incorporated; Tremco Butyl Sealant

F. Type Bn - Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.

1. Products:

a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com/#sle.

b. Tremco Commercial Sealants & Waterproofing; Acoustical/Curtainwall Sealant: www.tremcosealants.com/#sle.

c. Substitutions: See Section 016000 - Product Requirements.

2.4 SELF-LEVELING JOINT SEALANTS

A. Type Psl - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.

1. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.

2. Color: To be selected by Architect from manufacturer's standard range.

3. Service Temperature Range: Minus 40 to 180 degrees F.

4. Products:

a. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.

b. W. R. Meadows, Inc; POURTHANE SL: www.wrmeadows.com/#sle.

c. Tremco Incorporated; Vulkem 45SSL.

d. Pecora Corporation; NR-201.

e. Substitutions: See Section 016000 - Product Requirements.

B. Type Esr - Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.

1. Composition: Multicomponent, 100 percent solids by weight.

2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.

3. Color: To be selected by Architect from manufacturer's standard colors.

4. Joint Width, Minimum: 1/8 inch.

5. Joint Width, Maximum: 1/4 inch.

6. Products:

a. Adhesives Technology Corporation; CRACKBOND JF-90 HD: www.atcepoxy.com/#sle.

b. Euclid Chemical Company; EUCO 700: www.euclidchemical.com/#sle.

c. Mapei; Mapeiflex Joint Sealant EP 90/50: www.mapei.com/#sle.

d. Substitutions: See Section 016000 - Product Requirements.

2.5 ACCESSORIES

A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

B. Sealant Backing Rod, Closed-Cell Type: For exterior applications and joints subject to pedestrian or vehicular traffic.

1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.

2. Size: 25 to 50 percent larger in diameter than joint width.

C. Sealant Backing Rod, Open-Cell Type: For interior applications not subject to pedestrian or vehicular traffic.

D. Sealant Backing Rod, Bi-Cellular Type: For exterior applications and joints subject to pedestrian or vehicular traffic.

1. Cylindrical flexible sealant backings complying with ASTM C1330 Type B.

2. Size: 25 to 50 percent larger in diameter than joint width.

E. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

F. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

G. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

H. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.

1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.

2. Notify Architect of date and time that tests will be performed, at least seven days in advance.

3. Record each test on Preinstallation Adhesion Test Log as indicated.

4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.

5. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.3 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Thermally insulated hollow metal doors with frames.

1.2 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware.

B. Section 099113 - Exterior Painting: Field painting.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2024.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

I. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

O. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate with wall construction for anchor placement.

2. Coordinate installation of hardware.

3. Coordinate installation of electrical connections to electrical hardware items.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Door Schedule: Provide schedule coordinated with numbering on drawings and hardware schedule. Indicate door types and openings receiving electrified hardware.

D. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.6 QUALITY ASSURANCE

A. Conform to requirements of ANSI A250.8 - SDI-100, and as supplemented in this Section.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

C. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: https://steeldoor.org/sdi-certified/#sle.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

E. Maintain at project site copies of reference standards relating to installation of products specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

C. Inspect hollow metal products upon delivery for damage. Minor damage may be repaired provided refinishing is equal in all respects to new work and is acceptable to Architect; otherwise replace damaged items with new products as specified.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
3. Deansteel Manufacturing Company, Inc: www.deansteel.com/#sle.
4. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
5. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
6. Steelcraft, an Allegion brand: www.allegion.com/#sle.
7. Substitutions: See Section 016000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.

3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.

4. Door Edge Profile: Manufacturers standard for application indicated.

5. Typical Door Face Sheets: Flush, unless otherwise indicated on Drawings.

6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

    a. Prepare doors and frames for hardware in accordance with templates provided under Section 087100 - Door Hardware.

7. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) for exterior doors. Coating not required for typical interior door applications. Provide at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.

1. Grade: ANSI/SDI A250.8 (SDI-100); Level 3 - Extra Heavy-Duty, Physical Performance Level A, Model 1 - Full Flush (16 gage).

2. Door Core Material: Polystyrene, 1 lbs/cu ft minimum density Polyurethane, 1.8 lbs/cu ft minimum density.

    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.

3. Door Thermal Resistance: R-Value of 8.7, minimum, for installed thickness of polyurethane.

4. Door Thickness: 1-3/4 inches, nominal.

5. Top Closures for Outswinging Doors: Flush with top of faces and edges.

6. Door Finish: Factory primed and field finished.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.

1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.

2. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.

3. Frame Finish: Factory primed and field finished.

4. Weatherstripping: Separate, see Section 087100.

C. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

D. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

E. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.5 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 ACCESSORIES

A. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Silencers: Resilient rubber or vinyl, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.3 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. For frame installation, use concealed anchors where possible. Where exposed frame anchors are required, countersink fasteners, fill, and sand smooth.

C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

D. Install door hardware as specified in Section 087100.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

E. Touch up damaged factory finishes.

3.4 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.6 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION 081113

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ceiling framing.

B. Framing accessories.

1.2 RELATED REQUIREMENTS

A. Section 092900 - Gypsum Board: Execution requirements for anchors for attaching work of this section.

1.3 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

E. ASTM A645/A645M - Standard Specification for Pressure Vessel Plates, 5 % and 51 2 % Nickel Alloy Steels, Specially Heat Treated; 2010 (Reapproved 2022).

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

J. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Evaluation Reports: Submit evaluation reports for framing, tracks, anchors, and fasteners from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

B. Manufacturer Qualifications: Comply with one of the following:

1. Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

2. Member of Supreme Steel Framing System Association (SSFSA): www.ssfsa.com/#sle.

C. Code-Compliance Certification of Studs and Tracks: Provide framing members certified in accordance with the product-certification program of the the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202 "Code of Standard Practice."

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:

1. CEMCO: www.cemcosteel.com/#sle.

2. ClarkDietrich Building Systems: www.clarkdietrich.com/#sle.
3. Jaimes Industries: www.jaimesind.com/#sle.
4. Marino: www.marinoware.com/#sle.
5. MBA Building Supplies, Inc.: www.mbastuds.com.
6. MRI Steel Framing LLC: www.mristeelframing.com.
7. State Building Products, Inc.: http://www.statebp.com.
8. Steel Construction Systems: www.steelconsystems.com/#sle.
9. The Steel Network, Inc: www.SteelNetwork.com/#sle.
10. Substitutions: See Section 016000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design metal framing to comply with performance requirements, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.

1. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members" and ASTM A645/A645M, Section 10.

B. Performance Requirements:

1. Interior Suspended Gypsum Board Ceilings, Soffits, and Bulkheads: Design and install to provide deflection of not more than L/360 of distance between supports.
2. Interior Metal Stud/Gypsum Board Assemblies: Design and install to withstand lateral loading (air pressure) of 5 psf with deflection limit not more than L/240 of partition height.
3. Where documents indicate a stud size, size shall be considered minimum. Increase gage to meet minimum performance requirements.
4. Accommodate building structure deflections in connections to structure.

2.3 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645, galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated.

1. Protective Coating: ASTM A653/A653M, G40, (Z120); or coating with equivalent corrosion resistance, hot-dip galvanized unless otherwise indicated.

a. Galvannealed products are unacceptable.

2. Studs: C shaped with flat or formed webs.

   a. Minimum Base-Steel Thickness: 0.033 inch (20-gage drywall) unless otherwise indicated.

   b. Minimum Base-Steel Thickness at Wall Tile: 0.033 inch.

   c. Minimum Base-Steel Thickness at Opening Jambs: 0.033 inch.

3. Runners: U-shaped, sized to match studs.

   a. Minimum Base-Steel Thickness: Same as studs.

4. Equivalent Gauge Studs and Runners:

   a. High strength, roll-formed and embossed with surface deformations to stiffen the framing members so they are structurally comparable to conventional ASTM C645 steel studs and tracks.

   b. Minimum Base Steel Thickness: 0.0181 inch (20 EQ).

   c. Prohibited Locations: High-strength (EQ) studs may not be used at the following locations:

      1) Walls at vestibules or other areas expected to be exposed to wind loads greater than 5 psf.

      2) Walls to receive cement backer board, wall tile or other inflexible finishes.

      3) Walls to receive abuse resistant or impact resistant gypsum board.

      4) Walls used to support countertop construction, casework, audio/visual equipment, or other similar elements.

      5) Walls greater than 15 feet in height.

5. Ceiling Carrying Channels: C shaped (Main Runners).

   a. Minimum Base-Steel Thickness: 0.053 inch.

   b. Minimum Depth: 1-1/2 inches.

   c. Minimum flange width: 1/2 inch.

6. Ceiling Furring Channels (Furring Members):

   a. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

b. Steel Studs and Runners: 0.0296-inch minimum base-steel thickness.

c. Equivalent Gauge Studs and Runners: 0.0181 inch (20 EQ) minimum base-steel thickness.

d. Hat-Shaped, Rigid Furring Channels: 0.0296-inch minimum base-steel thickness, 7/8-inch deep.

7. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

a. Minimum Base-Steel Thickness: 0.0296 inch.

8. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-steel thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

B. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung, non-rated system unless otherwise rnoted, composed of main beams and cross-furring members that interlock.

C. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

D. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

E. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code when evaluated in accordance with AISI S100.

2. Material: ASTM A653/A653M steel sheet, SS Grade 50.

G. Non-Loadbearing Framing Accessories:

1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.

a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.

b. Products:

1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.

2) Substitutions: See Section 016000 - Product Requirements.

3. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; for lateral bracing of wall studs with slots for engaging on-module studs.

4. Framing Connectors: ASTM A653/A653M steel clips; secures cold rolled channel to wall studs for lateral bracing.

5. Flexible Wood Backing: Fire-retardant-treated wood with sheet steel connectors.

a. Products:

1) ClarkDietrich; Danback: www.clarkdietrich.com/#sle.

2) Substitutions: See Section 016000 - Product Requirements.

6. Sheet Metal Backing: 0.0538 inch thick, galvanized.

7. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

8. Fasteners: ASTM C1002 self-piercing self-tapping screws.

9. Anchorage Devices: Powder actuated.

10. Touch-Up Primer for Corrosion Protected Surfaces: SSPC-Paint 20 Type I - Inorganic.

H. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.

1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2. Tape Thickness: 1/4 inch.

3. Products:

a. Armacell LLC; ArmaComfort MTD: www.armacell.us/#sle.

b. Substitutions: See Section 016000 - Product Requirements.

I. Acoustic Insulation and Sealant: As specified in Section 092900 - Gypsum Board.

2.4 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

C. Examine areas and substrates for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION OF STUD FRAMING

A. Install non-structural members in accordance with ASTM C754.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install bracing at terminations in assemblies.

1. For interior non-load bearing walls indicated to terminate above suspended ceilings provide 20-gauge stud diagonal bracing of walls at door openings, corner wall intersections and at maximum 10’-0” intervals to structural supports or substrates above. Otherwise extend framing full height to structural supports or substrates above suspended ceilings.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

E. Extend partition framing to structure where indicated and to ceiling in other locations.

F. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

G. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

H. Align and secure top and bottom runners at 24 inches on center unless otherwise indicated.

I. At partitions indicated with an acoustic rating:

1. Install acoustic insulation, sealants, and accessories as described in 092900 - Gypsum Board.

2. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

J. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

K. Install studs vertically at spacing indicated on drawings unless otherwise required to meet performance requirements.

L. Install studs so flanges within framing system point in same direction.

M. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

N. Align stud web openings horizontally.

O. Secure studs to tracks using crimping method. Do not weld.

P. Stud splicing is not permissible.

Q. Fabricate corners using a minimum of three studs.

R. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.

1. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

2. 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.

S. Brace stud framing system rigid.

T. Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.

U. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

V. Furring: Coordinate with sound isolation clip spacing and locations. Lap splices a minimum of 6 inches.

W. Use backing/blocking for reinforcement of the following:

1. Framed openings.
2. Wall mounted cabinets.
3. Plumbing fixtures.
4. Toilet accessories.
5. Wall mounted door hardware.
6. Wall mounted televisions or other equipment.

3.4 CEILING AND SOFFIT FRAMING

A. Contractor's Option: At the Contractor's option suspended ceiling systems may be either suspended steel framing system or grid suspension system.

B. Comply with requirements of ASTM C754.

C. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

D. Install furring independent of walls, columns, and above-ceiling work.

E. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated.

1. Hanger spacing not to exceed 48 inches on center.

F. 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.
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.

G. Space main carrying channels at maximum 48 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.

H. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

I. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

J. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.

K. Laterally brace suspension system.

L. 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.

M. 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.

3.5 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Acoustic insulation.

C. Cementitious backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

A. Section 092216 - Non-Structural Metal Framing.

1.3 REFERENCE STANDARDS

A. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2024.

F. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2024.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

I. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

J. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

K. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2025.

L. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

M. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019 (Reapproved 2024).

N. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

P. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

Q. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2025.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Install service utilities in an orderly and expeditious manner.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on gypsum board, accessories, joint finishing system, and acoustic insulation and sealants.

1.6 QUALITY ASSURANCE

A. 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. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

C. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

D. Protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with requirements of ASTM C840 or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. American Gypsum Company: www.americangypsum.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Georgia-Pacific Gypsum: www.gpgypsum.com.
4. National Gypsum Company: www.nationalgypsum.com.
5. USG Corporation: www.usg.com.
6. Substitutions: See Section 016000 - Product Requirements.

2.2 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

2.3 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board unless otherwise required below.
    a. Glass mat faced gypsum panels are required for all pre-rock applications and gypsum installation prior to building being enclosed.

3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

    a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.

    b. Mold resistant board is required in areas subject to wetting, steam, or high humidity.

4. Thickness:

    a. Vertical Surfaces: 5/8 inch.

    b. Ceilings: 5/8 inch, unless otherwise noted.

    c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

5. Paper-Faced Products:

    a. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.

    b. American Gypsum Company; FireBloc Type C Gypsum Wallboard: www.americangypsum.com/#sle.

    c. CertainTeed Corporation; Type C Drywall: www.certainteed.com/#sle.

    d. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.

    e. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.

    f. Georgia-Pacific Gypsum; ToughRock Fireguard C: www.gpgypsum.com/#sle.

    g. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.

    h. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield C 5/8" Gypsum Board: www.goldbondbuilding.com/#sle.

    i. USG Corporation; Sheetrock Brand EcoSmart Panels Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.

    j. USG Corporation; Sheetrock Brand Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.

    k. Substitutions: See Section 016000 - Product Requirements.

6. Mold-Resistant, Paper-Faced Products:

    a. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.

    b. American Gypsum Company; M-Bloc Type C: www.americangypsum.com/#sle.

    c. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: www.certainteed.com/#sle.

    d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com/#sle.

    e. National Gypsum Company; Gold Bond XP Gypsum Board.

    f. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.

    g. USG Corporation; Sheetrock Brand EcoSmart Panels Mold Tough Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.

    h. USG Corporation; Sheetrock Brand Mold Tough Firecode SCX Panels 5/8 in. (15.9 mm): www.usg.com/#sle.

    i. Substitutions: See Section 016000 - Product Requirements.

B. Tile Backing Board for Wet Areas:

1. Application: Surfaces behind tile in wet areas including shower walls and other applications indicated in Drawings.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.

    a. Thickness: 1/2 inch.

    b. Products:

        1) Custom Building Products; Wonderboard Lite: www.custombuildingproducts.com.

        2) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: www.goldbondbuilding.com/#sle.

3) USG Corporation; DUROCK: www.usg.com/#sle..

4) Substitutions: See Section 016000 - Product Requirements.

2.4 GYPSUM BOARD ACCESSORIES

A. Sound Attenuation Insulation: ASTM C665; mineral fiber or glass fiber batt, friction fit type, unfaced.

1. Thickness: As indicated on Drawings, minimum 2 inches.

B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.

1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2. Tape Thickness: 1/4 inch.

C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

1. Products:

a. Franklin International, Inc; Titebond Acoustical Smoke & Sound Sealant: www.titebond.com/#sle.

b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.

c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.

d. Pecora Corporation; AC-20 FTR.

e. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.

f. Grabber Construction Products; Acoustical Sealant GSC.

g. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.

h. USG Corporation; SHEETROCK Acoustical Sealant.

i. Substitutions: See Section 016000 - Product Requirements.

2. Color of exposed acoustical joint sealants: Match adjacent surface.

D. Acoustical Outlet Box Pads:

1. Minimum thickness - 1/8 inch.

2. Adhesion - adheres readily to metal or plastic.

3. Service temperature - 30 degrees to 200 degrees F.

4. Shall contain no asbestos.

5. Minimum shelf life - 1 year.

6. Non Fire-Rated Products:

   a. Lowry's Outlet Box Pads as manufactured by Harry A. Lowry & Associates, Inc., Sun Valley, CA.

   b. Sound Pad #68 as manufactured by L.H. Dottie Co., City of Commerce, CA.

E. Finishing Accessories: ASTM C1047, galvanized steel, rolled zinc, rigid plastic, or composite, unless noted otherwise.

1. Types: As detailed or required for finished appearance.

2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, LC-bead, and Casing Bead at exposed panel edges.

3. Acceptable Products:

   a. Same manufacturer as framing materials.

   b. ClarkDietrich (Finishing Accessories) www.clarkdietrich.com

   c. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.

   d. Stockton Products: www.stocktonproducts.com/#sle.

   e. Trim-tex, Inc: www.trim-tex.com/#sle.

   f. Substitutions: See Section 016000 - Product Requirements.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Tape: 2 inch wide, coated glass fiber tape for joints and cornersexterior and glass-mat gypsum.

2. Tape: 2 inch wide, creased paper tape for joints and cornersfor interior gypsum board.

3. Tape for Tile Backing Panels: As recommended by panel manufacturer.

4. Joint Compound: Drying type, vinyl-based, ready-mixed.

G. Finishing Compound: Surface coat and primer, takes the place of skim coating.

H. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

K. Screws for Fastening of Gypsum Panel Products to Wood Framing or Blocking: Type W screws, corrosion resistant. Nails not permitted.

L. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

M. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

N. Adhesive for Attachment to Metal:

1. Products:

a. Franklin International, Inc; Titebond Drywall Construction Adhesive: www.titebond.com/#sle.

b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.

c. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

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 ACOUSTIC ACCESSORIES INSTALLATION

A. General: Limit installation of outlet boxes and other penetrations to one penetration per stud bay. Seal all penetrations and gaps with acoustic sealant, outlet box pads, or other acoustic shielding materials as approved by Architect in accordance with manufacturer's written instructions and tested assembly instructions.

B. Preparation for acoustic sealant:

1. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

2. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. 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.

3. 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.

C. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

D. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

E. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

F. Acoustic Sealant: Install as follows:

1. Comply with ASTM C919, ASTM C1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

2. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3. Place one bead continuously on substrate before installation of perimeter framing members.

4. Place continuous bead at perimeter of each layer of gypsum board.

5. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

G. Acoustical Outlet Box Pads: Install as follows within acoustic partitions:

1. Remove any water, excess dust, dirt and oil from the surfaces.

2. Comply with manufacturer's written instructions and UL requirements.

3. Ensure the entire surface is covered. Seal around conduit where it connects to outlet box using manufacturer's recommended materials.

3.3 BOARD INSTALLATION

A. Comply with ASTM C840 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

C. Form control and expansion joints with space between edges of adjoining gypsum panels.

D. 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. (0.7 sq. m) 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- (6.4- to 9.5-mm-) wide joints to install sealant.

E. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

F. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

G. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

H. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108/A118/A136.1 and manufacturer's instructions.

I. Installation on Metal Framing: Use screws for attachment of gypsum board.

J. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.4 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.5 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish, walls to receive wallcoverings, and other areas specifically indicated.

2. Level 4: Walls and ceilings to receive paint finish, unless otherwise indicated.

3. Level 3: Walls to receive textured wall finish.

4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

6. Level 0: Temporary partitions.

7. Level 0: Surfaces indicated to be finished in later stage of project.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.6 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.7 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

B. Repair damage from construction operations.

END OF SECTION 092900

SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient wall base.

B. Accessories.

1.2 REFERENCE STANDARDS

A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

1.3 SUBMITTALS

A. See Section 013000 - Administrative 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.

C. Selection Samples: If basis of design color is not provided, submit manufacturer's complete set of color samples for Architect's selection.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.5 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. Deliver and store materials in manufacturer's original unopened containers, with brand names and production lot numbers clearly marked.

E. Protect roll materials from damage by storing on end.

F. Do not double stack pallets.

1.6 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a minimum temperature of 65 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

B. Install resilient accessories after other finishing operations, including painting have been completed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. Manufacturers and products specified on Drawings.

2. Substitutions: See Section 01 6000 - Product Requirements.

2.2 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set.

1. Type: Style B, Cove.

2. Group: I (solid, homogeneous).

3. Height: 4 inch.

4. Thickness: 0.125 inch.

5. Finish: Satin.

6. Length: Roll.

7. Color: As indicated on drawings.

8. Acceptable Manufacturers:

a. Mannington Commercial: www.manningtoncommercial.com.

b. Johnsonite, a Tarkett Company: www.commercial.tarkett.com

c. Roppe Corp.: www.roppe.com.

d. ShawContract: www.shawcontract.com.

e. Substitutions: See Section 016000 - Product Requirements.

2.3 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Adhesives: Waterbased type recommended by flooring manufacturer.

1. Compatible with materials being adhered; maximum VOC content of 50 g/L.

C. Color: Color as selected from manufacturer's standards.

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. Prepare substrates as recommended by flooring and adhesive manufacturers.

B. Remove substrate ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

1. Prohibit traffic until filler is fully cured.

C. Clean substrate.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:

1. Spread only enough adhesive to permit installation of materials before initial set.

2. Fit joints and butt seams tightly.

3.4 INSTALLATION - RESILIENT BASE

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Fit joints tightly and make vertical. Install in longest lengths possible; maintain minimum dimension of 18 inches between joints.

C. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

D. Install base on solid backing. Bond tightly to wall and floor surfaces.

E. Do not stretch wall base during installation.

F. 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 096513

SECTION 096700 - FLUID-APPLIED FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.2 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

B. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3 REFERENCE STANDARDS

A. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.4 DEFINITIONS

A. DCOF: Dynamic Coefficient of Friction.

B. Slip-Resistant: Installed flooring surface which has a wet coefficient of friction of 0.42, minimum, as measured according to ANSI B101.3 (DCOF Slip Resistance Test).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this Section; require attendance by all affected installers, manufacturer, Contractor, and Architect.

1. Discuss installation testing, prep, procedures, details, and other pertinent issues.

1.6 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples for Selection: Submit samples showing range of options for color, texture, and aggregate for each system.

D. Samples for Verification: Submit two samples, 12 x 12 inch in size illustrating color and pattern for each floor material for each color specified.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Manufacturer's Certificate: Provide letter of certification from manufacturer stating that installer is a certified applicator and is familiar with manufacturers required procedures for application of specified finish system.

1. Slip-Resistance: Certify that specified floor finish system, when installed, comply with specified requirements for slip-resistance.

G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

H. Manufacturer's Qualification Statement.

I. Applicator's Qualification Statement.

J. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this Section.

1. Minimum five years of documented experience.

2. Approved by manufacturer.

C. Basis of Design: Specifications are based on flooring types by the specified basis of design manufacturer. Flooring types manufactured by other acceptable manufacturers are permitted, subject to compliance with all specified requirements; and provided that deviations in composition, construction, performance, and finish are minor and do not detract substantially from the indicated design intent.

1.8 MOCK-UP

A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture, slip resistance, and workmanship.

1. Number of Mock-Ups to be Prepared: One for each floor finish type.

2. Use same materials and methods for use in the work.

3. Locate where directed.

4. Minimum Size: 60 inches by 60 inches.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store resin materials in a dry, secure area.

C. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.10 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

D. Concrete substrate shall be properly cured for a minimum of 28 days.

1.11 WARRANTY

A. Fluid-applied Flooring: Provide manufacturer's warranty, as follows:

1. Materials: Minimum 2 years from Date of Substantial Completion.

2. Installation: Minimum 2 years from Date of Substantial Completion; warrant entire installation against loss of adhesion to substrates.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer:

1. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com.

B. Other Acceptable Manufacturers:

1. Key Resin Company: www.keyresin.com.

2. Stonhard, Inc.: https://www.stonhard.com/.

3. Terrazzo & Marble Supply Companies: www.tmsupply.com.

4. Tnemec Company, Inc.: www.tnemec.com.

5. Substitutions: See Division 01.

2.2 FLOORING APPLICATIONS - GENERAL

A. Slip-Resistance: Installed flooring must be slip resistant.

2.3 FLOORING MATERIALS

A. Fluid-Applied Flooring: Epoxy base coat(s) with broadcast quartz aggregate.

1. System Thickness: 1/8 inch, nominal, when dry.
2. Texture: Slip resistant.
3. Color: As scheduled in drawings
4. Basis of Design System: Resuflor - Deco Quartz DB23.
    a. Moisture Mitigation Primer:
        1) Material Design Basis: Resuprime MVP.
        2) Resin: Two component epoxy.
        3) Formulation Description: 100 percent solids.
        4) Application Method: Squeegee and back roll method.
        5) Number of Coats: One at 100 sf/gal.
    b. Broadcast Coat(s):
        1) Material Design Basis: Resuflor MPE.
        2) Resin: Two component epoxy.
        3) Formulation Description: 100 percent solids.
        4) Application Method: Squeegee and back roll method.
        5) Aggregates: Broadcast decorative quartz aggregate.
        6) Number of Coats: Two.
    c. Grout Coat:
        1) Material Design Basis: Resuflor UVE.
        2) Resin: Two component epoxy.
        3) Formulation Description: 100 percent solids.

4) Application Method: Squeegee and back roll method.

5) Number of Coats: One.

d. Topcoat:

1) Material Design Basis: Resuflor HTS 100.

2) Resin: Three component, aliphatic, moisture-cure urethane.

3) Formulation: 100 percent solids epoxy.

4) Application Method: Nap Roller.

5) Finish: Satin.

6) Number of Coats: One.

2.4 ACCESSORIES

A. Base Caps: Zinc or plastic with projecting base of 1/8 inch; color as selected.

B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

C. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

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 flooring.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied 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 fluid-applied flooring manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Prepare concrete surfaces according to ICRI 310.2R.

C. Prepare concrete surfaces according to manufacturer's guidelines.

D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

E. Vacuum clean substrate.

3.3 INSTALLATION - ACCESSORIES

A. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and top coating of cove base. Round internal and external corners.

B. Install terminating cap strip at top of base; attach securely to wall substrate.

3.4 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.

2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.

3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

    a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer to surfaces required by flooring manufacturer at manufacturer's recommended rate.

C. Apply each coat to minimum thickness required by manufacturer.

1. Mix and apply mortar and base coat(s) as indicated for flooring system and at coverage rates recommended in writing by manufacturer. Screed mortar materials, compact and smooth, with steel finishing trowels.

2. Aggregate: Broadcast in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer

3. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

D. Finish to uniform, level surface.

3.5 TERMINATIONS

A. Chase edges to “lock” the coating system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Treat floor drains by chasing the coating to lock in place at point of termination.

3.6 JOINTS AND CRACKS

A. Treat control joints to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Discontinue floor coating system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.7 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

END OF SECTION 096700

SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

E. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise 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. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.

7. Weathering steel.

8. Floors, unless specifically indicated.

9. Ceramic and other types of tiles.

10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco, unless otherwise noted.

11. Glass.

12. Concealed pipes, ducts, and conduits.

1.2 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

F. SSPC-SP 2 - Hand Tool Cleaning; 2024.

G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.

3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, siding, and factory finished metals, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. PPG Paints: www.ppgpaints.com/#sle.

2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

3. Benjamin Moore: www.benjaminmoore.com.

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

b. SCAQMD 1113 Rule.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated in Color Schedule.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.3 PAINT SYSTEMS - EXTERIOR

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including applications listed below.

1. Two top coats and one coat primer.

a. If flash rusting occurs, use two coats of primer.

2. Exterior Light Industrial Coating, Water Based; MPI #161, 163, or 164.

a. Application: Primed and galvanized metals (doors, fences, lintels, etc).

b. Products:

1) PPG Paints Pitt-Tech Plus WB DTM Industrial Enamel.

2) Benjamin Moore Super Spec HP DTM Acrylic.

3) Sherwin Williams Pro Industrial DTM Acrylic B66 Series.

3. Top Coat Sheen:

a. Flat: MPI gloss level 1; use this sheen for overhead surfaces.

b. Satin: MPI gloss level 4; use this sheen at wood, cementitous or masonry substrates unless otherwise noted.

c. Semi-Gloss: MPI gloss level 5; use this sheen at metal substrates unless otherwise noted.

4. Primer: As recommended by top coat manufacturer for specific substrate.

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Water Based Primer for Galvanized Metal; MPI #134.

a. Products:

1) Pittsburgh Paints: 4020 PF Pitt-Tech Plus Interior/Exterior Waterborne Acrylic Primer Finish DTM Industrial Enamel. (MPI #134).

2) Sherwin Williams Pro-Cryl Universal Metal Primer B-66 Series.

2. Rust-Inhibitive Water Based Primer.

a. Products:

1) Benjamin Moore: MO4 Acrylic Metal Primer.

2) ICI Paints: Devoe Coatings DevFlex 4020PF Direct to Metal Primer & Flat Finish.

3) PPG Industries: 90-708 Series, Pitt-Tech One-Pack Interior/Exterior Industrial Primer.

4) Sherwin Williams: DTM Acrylic Primer Finish B66W1.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

2. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

J. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

G. Sand metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.6 SCHEDULE

A. Naming Convention:

1. Substrate - Interior or Exterior - Opaque or Transparent - #Coats/Topcoat Type.

B. Paint M-E-OP-3DTM -Ferrous Metals, Unprimed, Opaque, 3 Coat:

1. One coat of primer.

2. Semi-gloss: Two coats of light industrial coating.

C. Paint M-E-OP-2DTM -Ferrous Metals, Primed, Opaque, 2 Coat:

1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Semi-gloss: Two coats of light industrial coating.

D. Paint Mg-E-OP-3DTM -Galvanized Metals, Opaque, 3 Coat:

1. One coat galvanize primer.
2. Semi-gloss: Two coats of light industrial coating.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.

2. Prime surfaces to receive wall coverings.

3. Mechanical and Electrical:

a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

b. In finished areas, paint shop-primed items.

c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

E. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise 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, bar code labels, and operating parts of equipment.

5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.

6. Marble, granite, slate, and other natural stones.
7. Floors, unless specifically indicated.
8. Ceramic and other tiles.
9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
10. Glass.
11. Acoustical materials, unless specifically indicated.
12. Concealed pipes, ducts, and conduits.

1.2 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

E. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

F. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

G. SSPC-SP 2 - Hand Tool Cleaning; 2024.

H. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

I. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").

2. MPI product number (e.g., MPI #47).

3. Cross-reference to specified paint system products to be used in project; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.

3. Allow 30 days for approval process, after receipt of complete samples by Architect.

4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as factory finished metals, wood cabinets, and wood doors, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Paint and Finish Materials: 1 gal of each color; from the same product run, store where directed.

2. Label each container with color in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Pittsburgh Paints: www.ppgpaints.com/#sle.

2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

3. Benjamin Moore: www.benjaminmoore.com.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 016000 - Product Requirements.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

b. SCAQMD 1113 Rule.

c. Architectural coatings VOC limits of the State in which the Project is located.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

A. LATEX PAINTS

1. Interior Latex Enamel.

a. Products:

1) PPG Paints Speedhide Zero Interior Latex, 6-4110XI Series, Flat. (MPI #53)

2) PPG Paints Speedhide Zero Interior Latex, 6-4310XI Series, Eggshell. (MPI #44)

3) PPG Paints Speedhide Zero Interior Latex, 6-4410XI Series, Satin. (MPI #52)

4) PPG Paints Speedhide Zero Interior Latex, 6-4510XI Series, Semi-Gloss. (MPI #54)

5) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat. (MPI #53)

6) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss. (MPI #43)

7) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #44)

8) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel. (MPI #52)

9) Benjamin Moore Ultra Spec 500 Flat N536. (MPI #53)

10) Benjamin Moore Ultra Spec 500 Low Sheen N537. (MPI #44)

11) Benjamin Moore Ultra Spec 500 Eggshell N538. (MPI #52)

12) Benjamin Moore Ultra Spec 500 Semi-Gloss N539. (MPI #43)

B. WATERBASED EPOXY PAINTS

1. Waterbased Epoxy.

a. Products:

1) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-310 Series, Eggshell. (MPI #151)

2) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-510 Series, Semi-Gloss. (MPI #153)

3) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #151)

4) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #153)

5) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, V342, Eggshell. (MPI #151)

6) Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, V341, Semi-Gloss. (MPI #153)

C. ACRYLIC PAINTS

1. Acrylic Enamel for Metal Surfaces (Non-Railing):

a. Products:

1) PPG Paints Pitt-Tech Plus WB DTM Industrial Enamel, 90-1210 Series, Semi-Gloss. (MPI #153)

2) Sherwin-Williams Pro Industrial DTM Acrylic, B66 Series, Semi-Gloss (MPI #153)

3) Benjamin Moore Super Spec HP DTM Acrylic, Semi-Gloss. (MPI #153)

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Interior/Exterior Latex Block Filler.

a. Products:

1) Kilz Pro-X p50 Block Filler Primer.

2) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15XI .

3) Sherwin-Williams PrepRite Block Filler.

2. Interior Drywall Primer Sealer.

a. Products:

1) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI.

2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28 Series.

3) Benjamin Moore Ultra Spec 500 Primer 534.

3. Interior Rust-Inhibitive Water Based Primer.

a. Products:

1) Pittsburgh Paints Pitt-Tech Plus Interior/Exterior EP DTM Waterborne Acrylic Primer/Finish, 90-1908. (MPI #107)

2) Sherwin-Williams Pro-Cryl Universal Waterbased Primer.

3) Benjamin Moore Ultra Spec HP Acrylic Metal Primer, HP04.

4. Interior Water Based Primer for Galvanized Metal.

a. Products:

1) Pittsburgh Paints Pitt-Tech Plus EP DTM Industrial Primer, 90-1912. (MPI #134)

2) Sherwin-Williams Pro-Cryl Universal Waterbased Primer.

3) Benjamin Moore Ultra Spec HP Acrylic Metal Primer, HP04.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

2. Prepare surface as recommended by top coat manufacturer.

3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.

G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

H. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

I. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

2. Prepare surface according to SSPC-SP 2.

J. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.

K. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Mechanical Work: Painting of mechanical work includes the following:

1. Interior Occupied Areas: Unless otherwise indicated, paint the following when exposed to view in finished construction:

a. Structural supports for mechanical equipment.

b. Mechanical equipment (except pre-finished equipment).

c. Piping, pipe hangers, and supports.

d. Ductwork.

e. Insulation on pipe and ductwork.

f. Accessory items.

g. Fire suppression system piping.

J. Electrical Work: Painting of electrical work includes the following:

1. Interior Occupied Areas: Unless otherwise indicated, paint the following when items exposed to view in finished construction:

    a. Structural supports for electrical equipment.

    b. Electrical equipment (except pre-finished equipment).

    c. Conduit and fittings, panels and boxes, and wiremold.

    d. Panelboards, including telephone equipment.

    e. Accessory items.

K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.6 SCHEDULE - PAINT SYSTEMS

A. Naming Convention:

1. Substrate - Interior or Exterior - Opaque or Transparent - #Coats/Topcoat Type.

B. Paint I-OP-3WE - CMU Substrates, Waterbased Epoxy (Semi-gloss):

1. Block Filler: Masonry Epoxy Block Filler 10 mils DFT.

2. Intermediate Coat: Waterbased Epoxy, 2.5-3.0 mils DFT.

3. Topcoats: Waterbased Epoxy, 2.5-3.0 mils DFT.

C. Paint M-I-OP-3AE - Steel Substrates, Acrylic Enamel (Semi-gloss):

1. Prime Coat: Rust-Inhibitive Water Based Primer, 3.0 mils DFT.

2. Intermediate Coat: Acrylic Enamel, 1.4 mils DFT.

3. Topcoats: Acrylic Enamel, 1.4 mils DFT.

D. Paint G-I-OP-3L - Gypsum Board Substrates, Latex Enamel (Ceilings - Flat; Walls - Eggshell, Unless Otherwise Noted):

1. Prime Coat: Interior Latex Primer Sealer, 1.4 mils DFT.

2. Intermediate Coat: Latex Enamel, 1.6 mils DFT.

3. Topcoats: Latex Enamel, 1.6 mils DFT.

E. Paint G-I-OP-3WE - Gypsum Board Substrates, Waterbased Epoxy (at Walls and Ceilings Where Noted):

1. Prime Coat: Interior Latex Primer Sealer, 1.4 mils DFT.

2. Intermediate Coat: Waterbased Epoxy, 1.6 mils DFT.

3. Topcoats: Waterbased Epoxy, 1.6 mils DFT.

END OF SECTION 099123

SECTION 101400 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

C. Signs required for Building Code compliance and building occupancy.

1.2 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 - 2010 ADA Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.3 SUBMITTALS

A. See Section 013000 - Administrative 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. 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.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years of documented experience.

1.5 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.

1.6 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.

PART 2 PRODUCTS

2.1 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:

1. Sign Type: Flat signs with graphic symbols and panel media as specified.

2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.

3. Character Height: 1 inch.

4. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.

5. Interior Rooms: Identify with room names and numbers to be determined later, not those shown on the Drawings, and braille.

C. Interior Directional and Informational Signs:

1. Sign Type: Flat signs with panel media as specified.

2. Tactile Exit Signs: Identify with either "EXIT" or "EMERGENCY EXIT" and braille.

a. Locations: Adjacent to each door to an egress stairway, exit passageway, and exit discharge.

D. Code-Required Door and Room Signs: Provide all signs required by Authority Having Jurisdiction (AHJ) for building occupancy; determine requirements and report to Owner and Architect prior to making specified submittals. Include cost of these signs in Contract Sum.

2.2 FLAT SIGNS

A. Flat Signs: Signage media without frame.

1. Material: Plastic or acrylic having a non-glare finish.

2. Edges: Square.

3. Corners: Square.

4. Wall Mounting of One-Sided Signs: Tape adhesive.

5. Signs Mounted on Glass: Where signs are mounted on glass, provide blank back-panel of matching size and material to conceal mounting unless otherwise noted.

B. Color and Font: Unless otherwise indicated:

1. Character Font: Helvetica, Arial, or other sans serif font.

2. Character Case: Upper case only.

3. Background Color: As selected by Architect from manufacturer's standard range.

4. Character Color: Contrasting color as selected.

2.3 ACCESSORIES

A. Mounting Devices: Except as specified for each sign type, provide mounting devices specifically recommended by manufacturer for indicated application; concealed upon finished installation.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.1 EXAMINATION

A. 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. Locate signs where indicated:

1. Emergency Evacuation Maps: Locate centered between elevator doors, or where indicated on Drawings.

2. If no location is indicated obtain Architect's instructions.

E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 101400

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

C. Utility room accessories.

1.2 RELATED REQUIREMENTS

A. Section 092216: Placement of reinforcement for backing plate reinforcement.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2025.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

F. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2023.

G. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).

H. ASTM C1036 - Standard Specification for Flat Glass; 2021.

I. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023a.

K. 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 to receive anchor attachments.

B. Coordinate locations of accessories with other work to avoid interference, and to assure proper operation and servicing of accessory units.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Provide accessories by the same manufacturer for each type of accessory unit. For units exposed in the same areas, provide matching finishes.

B. Comply with ASTM F446 for grab bars and accessories, anchorage, test methods, and performance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.

B. Pack accessories individually in a manner to protect accessory and its finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

1. As scheduled in Drawings.

B. Acceptable Manufacturers:

1. ASI - American Specialties, Inc: www.americanspecialties.com/#sle.

2. Bobrick Washroom Equipment, Inc: www.bobrick.com.

3. Bradley Corporation: www.bradleycorp.com/#sle.

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 two keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666/A666M, 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. Zinc Alloy: Die cast, ASTM B86.

G. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

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. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.

E. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.4 COMMERCIAL TOILET ACCESSORIES

A. As scheduled in Drawings.

2.5 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:

1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.

2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.

3. Construction: 1/8 inch flexible PVC.

   a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

   b. Comply with ICC A117.1.

4. Color: White.

5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.

2.6 UTILITY ROOM ACCESSORIES

A. 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. Hooks: Four, 0.06 inch stainless steel rag hooks at shelf front.

2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.

3. Length: 34-36 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 Section 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.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.4 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 102800

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 099113 - Exterior Painting: Preparation and painting of exterior piping systems.

C. Section 099123 - Interior Painting: Preparation and painting of interior piping systems.

D. Section 220523 - General-Duty Valves for Plumbing Piping.

E. Section 220553 - Identification for Plumbing Piping and Equipment: Piping identification.

F. Section 220719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.

B. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.

2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

C. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.2 PIPE-SLEEVE SEALS

A. Modular Mechanical Sleeve-Seal:
1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance with service requirements.
4. Service Requirements:
a. Corrosion resistant.
b. Underground, buried, and wet conditions.
c. Fire Resistant: 1 hour, UL (DIR) approved.
5. Glass-reinforced plastic pressure end plates.

B. Sealing Compounds:
1. Provide packing and sealing compound to fill pipe to sleeve thickness.
2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

C. Pipe Sleeve Material:
1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
2. Masonry Structures: Sheet metal or fiber.

D. Wall Sleeve: PVC material with waterstop collar, and nailer end-caps.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.2 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber complying with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch (15 mm) where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

E. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.3 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

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SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges.

B. Thermometers.

C. Pressure-temperature test plugs.

1.2 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2025).

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

D. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.

C. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. Bourdon Tube for Liquids and Gases:
   1. Dial Size and Cover: 4-1/2 inch (115 mm) diameter scale with polycarbonate window.
   2. Dial Text and Markings: Black color on white background with scaled kPa and psi units.
   3. Accuracy: ASME B40.100, adjustable commercial grade (D) with 5 percent of span.
   4. Process Connection: Lower-back, 1/4 inch (8 mm, DN) NPT male except where noted.

2.2 THERMOMETERS

A. General:
   1. Product Compliance: ASTM E1.
   2. Lens: Clear glass, except where stated.
   3. Accuracy: One percent, when tested in accordance with ASTM E77, except where stated.
   4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.

B. Thermometers - Adjustable Angle: 7 inch (177.8 mm) v-shape aluminum case with clear glass window scale, 6 inch (152.4 mm) NPT stem, red or blue organic non-toxic liquid filled glass tube, and adjustable joint with positive locking device allowing 360 degrees in horizontal plane or 180 degrees in vertical plane adjustments.

C. Thermometers - Dial Type:
   1. Fixed: 5 inch (125 mm) diameter dial with black pointer, stainless steel case, silicone damping bimetal element, hermetically sealed lens, recalibrating screw, and 2-1/2 inch (63.5 mm) NPT stem.
   2. Adjustable Angle: 5 inch (125 mm) diameter dial with black pointer, stainless steel case, silicone damping bimetal element, hermetically sealed lens, recalibrating screw, and 2-1/2 inch (63.5 mm) NPT stem.

2.3 PRESSURE-TEMPERATURE TEST PLUGS:

A. Size: 500 psi (34.5 bar) capacity; 1/2 inch (13 mm) MPT brass fitting with gasket, cap, and retaining strap for 1/8 inch (3 mm) pressure gauge or temperature probe.

B. Wetted Materials per Temperature Range:
   1. Up to 200 degrees F (93 degrees C): Brass probe with neoprene core.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports, and test plugs.

3.2 INSTALLATION

A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.

B. Install water meters with inlet and outlet isolation valves in compliance with AWWA M6.

C. Install pressure gauges as follows:
   1. At Pumps: Place single gauge before strainer, suction side and discharge side.
   2. Include gauge cock to isolate each gauge and extend nipples for insulation clearance.
   3. Adjust gauges to selected viewing angle, clean thoroughly, and calibrate to zero.

D. Install thermometers as follows:
   1. Hot Water Heaters: Place upstream and downstream of heater.
   2. Piping: Install thermometers in branch butt weld connection fitting or socket-weld thermowell. Enlarge pipes smaller than 2-1/2 inch (60 mm) to accommodate sockets. Ensure sockets are above insulation clearance.

E. Locate PT (pressure-temperature) test plugs adjacent to control device sockets.

END OF SECTION

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Ball valves.

B. Butterfly valves.

C. Check valves.

D. Globe valves.

1.2 RELATED REQUIREMENTS

1.3 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. TFE: Tetrafluoroethylene.

I. WOG: Water, oil, and gas.

1.4 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

D. ASME B31.9 - Building Services Piping; 2020.

E. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017 (Reapproved 2025).

F. AWWA C606 - Grooved and Shouldered Joints; 2022.

G. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

H. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

I. NSF 61 - Drinking Water System Components - Health Effects; 2024.

J. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.6 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

A. Apollo Valves: www.apollovalves.com/#sle.

B. Hammond Valve: www.hammondvalve.com/#sle

C. Milwaukee Valve: www.milwaukeevalve.com/#sle

D. NIBCO INC: www.nibco.com/#sle.

2.2 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: ball.
   2. Throttling: Provide globe.
   3. Swing Check (Pump Outlet):
      a. 2 inch (50 mm, DN) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
      b. 2-1/2 inch (65 mm, DN) and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:
   1. Steel Pipe:
      a. 2 inch (50 mm, DN) and Smaller: Threaded ends.
      b. 2-1/2 inch (65 mm, DN) to 4 inch (100 mm, DN): Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
   2. Copper Tube:
      a. 2 inch (50 mm, DN) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
      b. 2-1/2 inch (65 mm, DN) to 4 inch (100 mm, DN): Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.

F. Domestic, Hot and Cold Water Valves:
   1. 2 inch (50 mm, DN) and Smaller:
      a. Bronze: Provide with solder-joint or threaded ends.
      b. Ball: Two piece, full port, bronze with stainless-steel trim.
      c. Bronze Globe: Class 125, bronze disc.

2.3 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
   1. Handwheel: Valves other than quarter-turn types.
   2. Hand Lever: Quarter-turn valves 6 inch (150 mm, DN) and smaller except plug valves.

D. Insulated Piping Valves: With 2 inch (50 mm, DN) stem extensions and the following features:
   1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
   2. Butterfly Valves: Extended neck.

E. Valve-End Connections:
   1. Threaded End Valves: ASME B1.20.1.
   2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
   3. Solder Joint Connections: ASME B16.18.
   4. Grooved End Connections: AWWA C606.

F. General ASME Compliance:
   1. Solder-joint Connections: ASME B16.18.
   2. Building Services Piping Valves: ASME B31.9.

G. Potable Water Use:
   1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
   2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

2.4 BRONZE, BALL VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze Trim:
   1. Comply with MSS SP-110.
   2. WSP Rating: 150 psi (1035 kPa).
   3. WOG Rating: 600 psi (4140 kPa).
   4. Body: Forged bronze or dezincified-brass alloy.
   5. Ends Connections: Pipe thread or solder.
   6. Seats: PTFE.
   7. Stem: Bronze, blowout proof.
   8. Ball: Chrome plated brass.

2.5 BRONZE, SWING CHECK VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125:
   1. Pressure and Temperature Rating: MSS SP-80, Type 3.

2. Design: Y-pattern, horizontal or vertical flow.
3. WOG Rating: 200 psi (1380 kPa).
4. Body: Bronze, ASTM B62.
5. End Connections: Threaded.
6. Disc: Bronze.

2.6 BRONZE, GLOBE VALVES

A. General:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125 and Class 250:
   1. Class 125:
      a. WOG Rating: 200 psi (1380 kPa).
      b. WSP Rating: 125 psi (861.8 kPa), saturated.
   2. Class 250: WOG Rating; 300 psi (2070 kPa).
   3. Comply with MSS SP-80, Type 1.
   4. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
   5. End Connections: Threaded or solder.
   6. Bonnet: NRS; Non-rising Stem.
   7. Non-Rising Stem: Bronze.
   8. Disc: PTFE.
   9. Packing: Asbestos free.
   10. Handwheel Operator: Malleable iron.

PART 3 EXECUTION

3.1 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.2 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

END OF SECTION

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prefabricated trapeze-framed systems.

B. Strut systems for pipe or equipment support.

C. Beam clamps.

D. Pipe hangers.

E. Pipe supports, guides, shields, and saddles.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

M. FM (AG) - FM Approval Guide; Current Edition.

N. MFMA-4 - Metal Framing Standards Publication; 2004.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

P. UL (DIR) - Online Certifications Directory; Current Edition.

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

D. Materials for Metal Fabricated Supports: Comply with Section 055000.

1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

E. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

2.2 PREFABRICATED TRAPEZE-FRAMED SYSTEMS

A. Prefabricated Trapeze-Framed Metal Strut Systems:
1. MFMA-4 compliant, pre-fabricated, MSS SP-58 Type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
2. MFMA-4 compliant, prefabricated, side-loading continuous-slot metal strut channel bracket with associated tracks, fittings, and related accessories.
3. Strut Channel or Bracket Material:
   a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
5. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
6. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

2.3 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

B. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch (13 mm, DN) diameter.
   b. Piping up to 1 inch (25 mm, DN): 1/4 inch (6 mm, DN) diameter.
   c. Piping larger than 1 inch (25 mm, DN): 3/8 inch (10 mm, DN) diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) in length.

C. Channel Nuts:
1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.4 BEAM CLAMPS

A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.

B. C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.

C. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).

D. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.

E. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish.

F. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

G. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.5 PIPE HANGERS

A. Band Hangers, Adjustable:
   1. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

B. J-Hangers, Adjustable:
   1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

C. Swivel Ring Hangers, Adjustable:
   1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
   2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   3. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.
   4. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

D. Clevis Hangers, Adjustable:
   1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
   2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
   3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
   4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
   5. UL (DIR) listed: Pipe sizes 2-1/2 to 8 inch (65 to 200 mm, DN).

2.6 PIPE CLAMPS

A. Riser Clamps:
   1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
   3. UL (DIR) listed: Pipe sizes 1/2 to 8 inch (15 to 200 mm, DN).

B. Strut Clamps:
   1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

C. Insulation Coupling:
   1. Two bolt-type clamps designed for installation under insulation.
   2. Material: Carbon steel with epoxy copper or zinc finish.

2.7 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

B. Stanchions:
   1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
   2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

C. U-Bolts:
   1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.

D. Pipe Shields for Insulated Piping:
   1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   2. General Construction and Requirements:
      a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
      b. Shields Material: UV-resistant polypropylene with glass fill.
      c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
      d. Service Temperature: Minus 40 to 178 degrees F (Minus 40 to 81 degrees C).
      e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

E. Pipe Supports:
   1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   2. Liquid Temperatures Up to 122 degrees F (50 degrees C):
      a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
      b. Support From Below: MSS SP-58 types 35 through 38.

F. Pipe Supports, Thermal Insulated:
   1. General Requirements:
      a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
      b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
      c. Provide pipe supports for 1/2 to 30 inch (15 to 750 mm, DN) iron pipes.
      d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
   2. PVC Jacket:
      a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
      b. Moisture Vapor Transmission: 0.0071 perm inch (0.0092 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
      c. Minimum Thickness: 60 mil, 0.06 inch (1.524 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

1.2 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:
   1. Heat exchangers, water heaters, and other heat transfer products.
   2. Control panels, transducers, and other related control equipment products.
   3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.

B. Tags:
   1. Piping: 3/4 inch (20 mm) diameter and smaller.
   2. Manual operated and automated control valves.

C. Pipe Markers: 3/4 inch (20 mm) diameter and higher.

2.2 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Engraved piece with up to three lines of text.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch (6 mm).
   3. Background Color: Black.
   4. Nameplate Height: 3/4 inch (19 mm).
   5. Nameplate Material:
      a. Flexible: Polycarbonate with center-side holes for screw fastening per ASTM D709.
      b. Metal: Brass with center-side holes for screw fastening.

2.3 TAGS

A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch (40 mm) in diameter.

B. Metal: Brass, 19 gauge 1-1/2 inch (40 mm) in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

C. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

D. Piping: 3/4 inch (20 mm) diameter and smaller. Include corrosion resistant chain. Identify service, flow direction, and pressure.

2.4 STENCILS

A. Pipe: Stencil size required per external insulated or uninsulated pipe diameter.

B. Background Paint: Semi-gloss enamel in compliance with Section 099123.

C. Fluid Service Identification Scheme, ASME A13.1:
   1. Water; Potable, Cooling, Boiler Feed and Other: White text on green background.

2.5 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. Seton Identification Products: www.seton.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Comply with ASME A13.1.

C. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

D. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

E. Identification Scheme, ASME A13.1:

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive identification products.

B. Prepare surfaces for stencil painting, see Section 099123.

3.2 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping

C. Apply stencil painted identification in compliance with Painting Section 099123 requirements. Identify unit with assigned id-number and area being served using pipe marking rules.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.

F. Apply ASME A13.1 Pipe Marking Rules.
   1. Place pipe marker adjacent to changes in direction.
   2. Place pipe marker adjacent each valve port and flange end.
   3. Place pipe marker at both sides of floor and wall penetrations.
   4. Place pipe marker every 25 to 50 feet (7.6 to 15.2 m) interval of straight run.

END OF SECTION

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SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Flexible elastomeric cellular insulation.

B. Glass fiber insulation.

C. Jacketing and accessories.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

F. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

I. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.6 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER INSULATION

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.owenscorning.com/en-us/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm (0.029 ng/(Pa s m)).

D. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA; AEROFLEX Self-Seal: www.aeroflexusa.com/#sle.
   2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
   3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Weather Barrier: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.4 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (Minus 18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/(Pa s m)), maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch (0.25 mm).

e. Connections: Brush on welding adhesive.

B. Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch (0.00 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
4. Finish: Match insulation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Inserts and Shields:
1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

H. Buried domestic water piping: do not insulate.

END OF SECTION

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SECTION 221005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet (1500 mm) of building.
B. Sanitary waste piping, above grade.
C. Domestic water piping, buried within 5 feet (1500 mm) of building.
D. Domestic water piping, above grade.
E. Storm drainage piping, buried within 5 feet (1500 mm) of building.
F. Storm drainage piping, above grade.
G. Natural gas piping, buried within 5 feet (1500 mm) of building.
H. Natural gas piping, above grade.
I. Pipe flanges, unions, and couplings.
J. Pipe hangers and supports.
K. Pipe sleeve-seal systems.
L. Ball valves.
M. Butterfly valves.
N. Pressure reducing valves.
O. Pressure relief valves.
P. Pressure-temperature valves.
Q. Strainers.

1.2 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.
B. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.
C. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.
D. Section 220553 - Identification for Plumbing Piping and Equipment.
E. Section 330110.58 - Disinfection of Water Utility Piping Systems.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
E. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.
F. ASME B31.1 - Power Piping; 2024.
G. ASME B31.9 - Building Services Piping; 2020.
H. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.

I. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

N. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

O. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

P. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

Q. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

R. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

S. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

T. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

U. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2021.

V. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

W. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

X. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

Y. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).

Z. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 2021.

AA. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2024.

BB. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2024.

CC. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

DD. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.

EE. AWWA C606 - Grooved and Shouldered Joints; 2022.

FF. AWWA C651 - Disinfecting Water Mains; 2023.

GG. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

HH. FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential; 1989.

II. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

JJ. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections; 2022.

KK. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

LL. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

MM. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

NN. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

OO. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

PP. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

QQ. MSS SP-67 - Butterfly Valves; 2022.

RR. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

SS. NSF 61 - Drinking Water System Components - Health Effects; 2024.

TT. NSF 372 - Drinking Water System Components - Lead Content; 2024.

UU. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe; 2024.

VV. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.2 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

B. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.
   1. Fittings: PVC.
   2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

2.3 SANITARY WASTE PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

B. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.4 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Pipe: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: Grooved mechanical couplings.
   3. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IPC), and IAPMO (UPC) approved, NSF 61 and NSF 372 certified, with EPDM seals.

B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. PPI TR-4 Pressure Design Basis:
      a. 160 psig (1102 kPa) at maximum 73 degrees F (23 degrees C).
      b. 100 psig (689 kPa) at maximum 180 degrees F (82 degrees C).
   2. Fittings: Brass and copper.
   3. Joints: Mechanical compression fittings.

2.5 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

B. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.
   1. Fittings: PVC.
   2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

2.6 STORM DRAINAGE PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.7 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type.
   2. Joints: ASME B31.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.

2.8 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.9 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch (80 mm, DN) and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.
   2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes Over 1 inch (25 mm, DN):
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47/A47M malleable iron, ductile iron, or _____, galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F (minus 34 degrees C) to 230 degrees F (110 degrees C).
   4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

D. No-Hub Couplings:
   1. Testing: In accordance with ASTM C1277 and CISPI 310.
   2. Gasket Material: Neoprene complying with ASTM C564.
   3. Band Material: Stainless steel.

4. Eyelet Material: Stainless steel.

E. Shielded, Heavy Duty No-Hub Couplings:
1. Testing: In accordance with ASTM C1540 and FM 1680.
2. Gasket Material: Neoprene complying with ASTM C564.
3. Band Material: Stainless steel.
4. Eyelet Material: Stainless steel.

F. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.10 PIPE HANGERS AND SUPPORTS

A. See Section 220529 for additional requirements.

B. Provide hangers and supports that comply with MSS SP-58.
1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.

C. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 inch (80 mm, DN): Cast iron hook.
4. Wall Support for Pipe Sizes 4 inch (100 mm, DN) and Over: Welded steel bracket and wrought steel clamp.
5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

D. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 to 4 inch (50 to 100 mm, DN): Carbon steel, adjustable, clevis.
4. Wall Support for Pipe Sizes Up to 3 inch (80 mm, DN): Cast iron hook.
5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

E. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.
3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Comply with ICC-ES AC308.
6. Other Types: As required.

2.11 PIPE SLEEVE-SEAL SYSTEMS

A. Modular Mechanical Seals:

1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance to service requirements.
4. Glass reinforced plastic pressure end plates.

B. Wall Sleeve: PVC material with water-stop collar, and nailer end-caps.

2.12 BALL VALVES

A. Construction, 4 inch (100 mm, DN) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.13 BUTTERFLY VALVES

A. Construction 1-1/2 inch (40 mm, DN) and Larger: MSS SP-67, 200 psi (1380 kPa) CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

B. Provide gear operators for valves 8 inches (150 mm, DN) and larger, and chain-wheel operators for valves mounted over 8 feet (2400 mm) above floor.

2.14 PRESSURE REDUCING VALVES

A. 2 inch (50 mm, DN) and Smaller:
   1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
   2. Pressure Reducing Pilot-Operator:
      a. Operating Range: 5 to 50 psi (0.35 to 35 Bar).
      b. Connected into brass or bronze pilot piping and fittings.
      c. Fixed flow restrictor, pressure gauges, and isolation valves.

B. 2 inch (50 mm, DN) and Larger:
   1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
   2. Pressure Reducing Pilot-Operator:
      a. Operating Range: 5 to 50 psi (0.35 to 35 Bar).
      b. Connected into brass or bronze pilot piping and fittings.
      c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.15 PRESSURE RELIEF VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.16 STRAINERS

A. Size 1/2 inch (15 mm, DN) to 3 inch (80 mm, DN):
   1. Class 150, threaded forged bronze Y-pattern body, stainless steel perforated mesh screen with cap, and rated for 150 psi (1,034 kPa), 250 deg F (121.1 deg C) WOG service.

B. Size 2 inch (50 mm, DN) and Smaller:
   1. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
   2. Class 150, threaded bronze body 300 psi (2070 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 220516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 083100.

I. Provide support for utility meters in accordance with requirements of utility companies.

J. Install bell and spigot pipe with bell end upstream.

K. Install valves with stems upright or horizontal, not inverted. See Section 220523.

L. Install water piping to ASME B31.9.

M. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

N. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

O. Sleeve pipes passing through partitions, walls, and floors.

P. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
   4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

8. Provide copper plated hangers and supports for copper piping.

Q. Pipe Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Provide spring-loaded check valves on discharge of water pumps.

D. Provide flow controls in water recirculating systems where indicated.

3.5 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch (10 mm) vertically of location indicated and slope to drain at minimum of 1/8 inch per foot (1:100) slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.6 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
1. Perform hydrostatic testing for leakage prior to system disinfection.
2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
3. General:
a. Fill the system with water and raise static head to 10 psi (345 kPa) above service pressure. Minimum static head of 50 to 150 psi (345 to 1,034 kPa). As an exception, certain codes allow a maximum static pressure of 80 psi (551.6 kPa).

C. Gas Distribution Systems:
1. Test Preparation: Close each appliance valve or disconnect and cap each connected appliance.
2. General Systems:
a. Inject a minimum of 10 psi (68.9 kPa) of compressed air into the piping system for a duration of 15 minutes and verify with a gauge that no perceptible pressure drop is measured.
b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound (0.45 kg).

D. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 330110.58.

B. Prior to starting work, verify system is complete, flushed, and clean.

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.8 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, and sand strainer.

3.9 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inch (15 mm, DN) to 1-1/4 inch (32 mm, DN):
         1) Maximum Hanger Spacing: 6.5 ft (2 m).
         2) Hanger Rod Diameter: 3/8 inches (9 mm).
      b. Pipe Size: 1-1/2 inch (40 mm, DN) to 2 inch (50 mm, DN):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).
      c. Pipe Size: 2-1/2 inch (65 mm, DN) to 3 inch (80 mm, DN):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 1/2 inch (13 mm).
   2. Plastic Piping:
      a. All Sizes:
         1) Maximum Hanger Spacing: 6 ft (1.8 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

SECTION 221006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleanouts.

B. Water hammer arrestors.

1.2 RELATED REQUIREMENTS

A. Section 223000 - Plumbing Equipment.

1.3 REFERENCE STANDARDS

A. NSF 61 - Drinking Water System Components - Health Effects; 2024.

B. NSF 372 - Drinking Water System Components - Lead Content; 2024.

C. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements for additional provisions.
   2. Extra Loose Keys for Outside Hose Bibbs: One.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. MIFAB, Inc: www.mifab.com/#sle.
   4. Sioux Chief Manufacturing Company, Inc.: www.siouxchief.com/#sle.
   5. Zurn Industries, LLC: www.zurn.com/#sle.

B. Cleanouts at Exterior Surfaced Areas:
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas:
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.3 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Water Hammer Arrestors:
   1. Copper or Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks.

END OF SECTION

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Circulators.

1.2 SUBMITTALS

A. Product Data:
   1. Provide certified pump curve with duty point marked over pump and system operating conditions and NPSH curve and power requirement by pump tag.
   2. Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.

B. Shop Drawings: Include dimensions and performance data.

C. Test Reports: Plumbing fixture operational tests.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.3 QUALITY ASSURANCE

A. Identification: Provide pumps with manufacturer's name, model number, and rated capacity identified by permanently attached label.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.1 CIRCULATORS

A. Manufacturers:
   1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
   2. Bell & Gossett, a Brand of Xylem, Inc: www.xylem.com/#sle.
   3. Grundfos Pumps Corporation: www.grundfos.com/#sle.
   4. Taco, Inc: www.tacocomfort.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Casing: Bronze with bronze cast impeller, and stainless steel rotor assembly.

C. Shaft: Alloy steel with integral thrust collar and two oil-lubricated bronze sleeve bearings.

D. Mechanical Seal: Carbon rotating against a stationary ceramic seat.

E. Pipe-End Connection: Union connection.

F. Maximum Discharge Pressure: 145 psi (1000 kPa).

G. Motor: 1,750 rpm, ECM duty with flexible coupling.

H. Service Temperature Range: Minus 30 to 250 degrees F (Minus 34.4 to 121.1 degrees C).

I. Controls: Provide aquastat set for high-temp cutoff, electric plug, and illuminated hand switch.

J. Accessories: Include inlet-outlet temperature and pressure gauges with 2-way isolation valves.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products with related fittings, and accessories according to manufacturer instructions.

B. Potable and Drinking Water Service: Provide NSF 61 certified; comply with ICC (IPC).

C. Ensure that small pressure gauges are installed on both upstream and downstream ends.

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are nonoverloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.2 FIELD QUALITY CONTROL

A. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.3 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.4 PROTECTION

A. Protect installed products from damage due from subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

END OF SECTION

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleanouts.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on fabrication materials, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store products under cover and protected from weather and dirt. Elevate above grade.

B. Store plastic products protected from direct sunlight.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Plastic Sanitary Waste Piping Specialties: Provide plastic products that comply with NSF 14.

2.2 CLEANOUTS

A. Manufacturers:
   1. MIFAB, Inc: www.mifab.com/#sle.
   2. Sioux Chief Manufacturing Company: www.siouxchief.com/#sle
   3. Wade: www.wadedrains.com/#sle
   4. Zurn Industries, LLC: www.zurn.com/#sle.

B. Floor Cleanouts:
   1. Assembly: ASME A112.36.2.
   2. Body: Lacquered cast iron or PVC.
   3. Closure Plug: Bronze or PVC, threaded, gastight and watertight.
   4. Top: Adjustable.
      a. Shape and Finish:
         1) All Locations, Unless Noted Otherwise: Round; nickel bronze.

C. Wall Cleanouts:
   1. Assembly: ASME A112.36.2.
   2. Body: Tee type; body material to match surrounding pipe.
   3. Plug: Bronze or PVC, threaded, gastight.
   4. Access Cover: Round, stainless steel wall access cover.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Ensure clearance at cleanout for rodding or jetting of drainage system.

C. Install floor cleanouts to allow for floor finishes.

D. Locate, provide, and install cleanouts in piping in accordance with adopted code.

END OF SECTION

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SECTION 223000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tankless electric water heaters.

1.2 SUBMITTALS

A. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Provide electrical characteristics and connection requirements.

B. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:
   1. Water Heaters: NSF approved.
   2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.5 WARRANTY

A. Manufacturer Warranty: Provide 5-year manufacturer warranty for domestic water heaters. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Tankless Electric Water Heater:
   1. Manufacturers:
      a. Bradford White Corporation; KwickShot: www.bradfordwhite.com/#sle.
      b. eEMAX, iNC.: WWW.EEMAX.COM/#SLE.
   2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
   3. Heater Type: Self-contained, wall-mounted unit capable of handling listed capacity, water-inlet strainer, removable thermally-insulated front panel, and threaded water pipe-end connections.
   4. Heater-Heat Exchanger: Stainless steel, thermally insulated and encased assembly in corrosion-resistant steel jacket; baked-on enamel finish.
   5. Safeties: Provide internal safeties for water flow, electrical load, and thermal load.
   6. Controls: selectable display including temperature, setpoint, flow rate, inlet temperature, outlet temperature, power factor, error/fault.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B. Coordinate system, equipment, and piping work with applicable electrical support interconnections as included or provided by other trades.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

1.2 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

D. NSF 61 - Drinking Water System Components - Health Effects; 2024.

E. NSF 372 - Drinking Water System Components - Lead Content; 2024.

F. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on-site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.1 PRODUCT INFORMATION

A. REFER TO "PLUMBING FIXTURE SPECIFICATIONS" SCHEDULE ON SHEET P6.1.

2.2 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.3 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

A. Clean plumbing fixtures and equipment.

3.7 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.2 REFERENCE STANDARDS

A. NEMA MG 00001 - Motors and Generators; 2024.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Comply with NFPA 70.

C. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of high efficiency motors.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.6 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 104 degrees F (40 degrees C) environment.
   3. Design for temperature rise in accordance with NEMA MG 00001 limits for insulation class, service factor, and motor enclosure type.

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.2 APPLICATIONS

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

I. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. FM (AG) - FM Approval Guide; Current Edition.

L. MFMA-4 - Metal Framing Standards Publication; 2004.

M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

N. UL (DIR) - Online Certifications Directory; Current Edition.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems and nonpenetrating rooftop supports.

C. Installer's Qualifications: Include evidence of compliance with specified requirements.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: Comply with Section 055000.

C. Prefabricated Trapeze-Framed Metal Strut Systems:
   1. MFMA-4 compliant, pre-fabricated, MSS SP-58 type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.

2. MFMA-4 compliant, prefabricated, side-loading continuous-slot metal strut channel bracket with associated tracks, fittings, and related accessories.
3. Strut Channel or Bracket Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
5. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 13/16 inch (21 mm) height.
6. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

D. Strut Channels:
1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

E. Channel Nuts:
1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring.

F. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch (13 mm) diameter.
   b. Piping up to 1 inch (25 mm, DN): 1/4 inch (6 mm) diameter.
   c. Piping larger than 1 inch (25 mm, DN): 3/8 inch (10 mm) diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.

G. Cable Hanging System Kits:
1. Provide cable-wire in bulk or precut lengths with respective cable hangers as required to hold minimum weight of 120 lb (54.4 kg).
2. Accessories: Provide brackets, clip or c-clip hangers, covers, and y-hook hangers.

H. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up To 122 degrees F (50 degrees C):
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.
3. Operating Temperatures from 122 to 446 degrees F (50 to 230 degrees C):
   a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.

I. Pipe Stanchions:
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

J. Beam Clamps:
1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish,
7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

K. Riser Clamps:
1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch (15 to 200 mm, DN).

L. U-Bolts:
1. MSS SP-58 Type 24, carbon steel u-bolt for pipe support or anchoring.

M. Strut Clamps:
1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
2. Service Temperature Range: Minus 65 to 275 degrees F (Minus 53.8 to 135 degrees C).

N. Insulation Clamps:
1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper or zinc finish.

O. Pipe Hangers:
1. Split Ring Hangers:
   a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
   b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
   c. Provide hanger rod and nuts of the same type and material for a given pipe run.
   d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
2. Swivel Ring Hangers, Adjustable:
   a. MSS SP-58 Type 10, epoxy-painted, zinc-colored.

b. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
c. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.

3. Clevis Hangers, Adjustable:
a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
b. Light-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
c. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
d. UL (DIR) listed: Pipe sizes 2-1/2 to 8 inch (65 to 200 mm, DN).

P. Pipe Shields for Insulated Piping:
1. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
d. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
e. Maximum Service Temperature: 178 degrees F (81 degrees C).
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

Q. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
7. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.
8. Sheet Metal: Use sheet metal screws.
9. Wood: Use wood screws.
10. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel.
c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

G. Secure fasteners according to manufacturer's recommended torque settings.

H. Remove temporary supports.

END OF SECTION

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

1.2 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags. Key to control schematic.

B. Control Panels: Nameplates.

C. Ductwork: Nameplates.

D. Heat Transfer Equipment: Nameplates.

E. Instrumentation: Tags.

F. Major Control Components: Nameplates.

G. Piping: Tags.

H. Pumps: Nameplates.

I. Small-sized Equipment: Tags.

J. Tanks: Nameplates.

K. Valves: Tags and ceiling tacks where located above lay-in ceiling.

L. Water Treatment Devices: Nameplates.

2.2 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.

4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Letter Color: White.

C. Letter Height: 1/4 inch (6 mm).

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.3 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
2. Brady Corporation: www.bradycorp.com/#sle.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
7. Substitutions: See Section 016000 - Product Requirements.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:
1. Brimar Industries, Inc: www.pipemarker.com/#sle.
2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch (0.76 mm); printed with UV and chemical resistant inks.

C. Style: Individual Label.

D. Color: Yellow/Black.

2.5 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

E. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.
   2. Toxic and Corrosive Fluids: Orange with black letters.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 099123 for stencil painting.

3.2 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch (20 mm) diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

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SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

D. Commissioning activities.

1.2 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements: Employment of testing agency and payment for services.

1.3 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024, with Errata (2025).

C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract. The following are approved test and balance contractors. No others may be used or their work will be dismissed and test and balance will need to be done again.
   1. HiTech Test and Balance, Freeland
   2. Great Lakes Balancing, Grand Rapids.
   3. Integrity Test and Balance, Traverse City
   4. Ener-Tech Testing, Holly
   5. Control Solutions, grand rapids/rochester hills/Alpena

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to the Commissioning Authority and ARCHITECT.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

e. Final test report forms to be used.
f. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
g. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
h. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit to the the Architect within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations. Provide additional PDF of same.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Include the following on the title page of each report:
a. Name of Testing, Adjusting, and Balancing Agency.
b. Telephone number of Testing, Adjusting, and Balancing Agency.
c. Project name.
d. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. SMACNA (TAB).
4. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section. See approved TEST and BALANCE contractors above.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to be replaced or will have its system revised.

B. Measure and record the operating speed, flow rate, and head pressure of each pump.
   1. Measure the flow rate in each of the hydronic loops leaving the boiler room.
   2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
   3. Check bearings and other lubricated parts for proper lubrication.
   4. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

C. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
   1. Bearings and other parts are properly lubricated.
   2. Deficiencies noted in the preconstruction report are corrected.

D. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
   1. Compare the indicated water flow of the renovated work to the measured flows, and determine the balance valve settings.
   2. If calculations increase or decrease the water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.

3.3 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.

9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Pumps are rotating correctly.
13. Proper strainer baskets are clean and in place.
14. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.4 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide additional balancing devices as required.

3.5 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.6 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.7 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

3.8 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.9 SCOPE

A. Test, adjust, and balance the following:
   1. Plumbing Pumps.
   2. HVAC Pumps.
   3. Boilers.
   4. Air Coils.
   5. Air Handling Units.
   6. Unit Ventilators.
   7. Fans.
   8. Air Filters.
   9. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Starter size, rating, heater elements.
   8. Sheave Make/Size/Bore.

B. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.
   5. Service.
   6. Design flow rate, pressure drop, BHP.
   7. Actual flow rate, pressure drop, BHP.
   8. Discharge pressure.
   9. Suction pressure.
   10. Total operating head pressure.
   11. Shut off, discharge and suction pressures.
   12. Shut off, total head pressure.

C. Combustion Equipment:
   1. Boiler manufacturer.
   2. Model number.
   3. Serial number.
   4. Firing rate.
   5. Gas flow rate.
   6. Heat input.
   7. Burner manifold gas pressure.
   8. Flue gas temperature at outlet.
   9. Heat output.

D. Heating Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Water flow, design and actual.
   7. Water pressure drop, design and actual.
   8. Entering water temperature, design and actual.
   9. Leaving water temperature, design and actual.
   10. Entering air temperature, design and actual.
   11. Leaving air temperature, design and actual.
   12. Air pressure drop, design and actual.

E. Air Moving Equipment:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Serial number.
   5. Arrangement/Class/Discharge.
   6. Air flow, specified and actual.
   7. Return air flow, specified and actual.
   8. Outside air flow, specified and actual.
   9. Total static pressure (total external), specified and actual.
   10. Inlet pressure.
   11. Discharge pressure.
   12. Sheave Make/Size/Bore.
   13. Number of Belts/Make/Size.
   14. Fan RPM.

F. Exhaust Fans:
   1. Location.
   2. Manufacturer.
   3. Model number.
   4. Serial number.
   5. Air flow, specified and actual.
   6. Total static pressure (total external), specified and actual.
   7. Inlet pressure.
   8. Discharge pressure.
   9. Sheave Make/Size/Bore.
   10. Number of Belts/Make/Size.
   11. Fan RPM.

G. Air Distribution Tests:
   1. Air terminal number.
   2. Room number/location.
   3. Terminal type.
   4. Terminal size.
   5. Design air flow.
   6. Test (final) air flow.
   7. Percent of design air flow.

END OF SECTION

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SECTION 230713 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.

B. Weather barrier coatings.

C. Jacketing and accessories.

1.2 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.
   4. Knauf Insulation; Performance+ Duct Wrap: www.knaufinsulation.com/#sle.
   5. Manson Insulation, a company of Knauf Insulation; Alley Wrap B: www.imanson.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

D. Indoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:

1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

END OF SECTION

SECTION 230719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

1.2 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, RIGID

A. Manufacturers:
   1. CertainTeed Corporation; _____: www.certainteed.com/#sle.
   2. Johns Manville Corporation; _____: www.jm.com/#sle.
   3. Knauf Insulation; Earthwool Pipe Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.owenscorning.com/en-us/#sle.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K (Ksi) Value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/(Pa s m)).

PART 3 EXECUTION

3.1 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

E. Inserts and Shields:
   1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

END OF SECTION

SECTION 230800 - COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 SUMMARY

A. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - Application of the Commissioning Process to New HVAC&R Systems; 2025.

1.3 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

C. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
   1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
   2. Full as-built set of control drawings.
   3. Full as-built sequence of operations for each piece of equipment.
   4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
      a. Floor.
      b. Room number.
      c. Room name.
      d. Air handler unit ID.
      e. Reference drawing number.
      f. Air terminal unit tag ID.

g. Heating and/or cooling valve tag ID.
h. Minimum air flow rate.
i. Maximum air flow rate.

5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

D. Project Record Documents: See Section 017800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

E. Draft Training Plan: In addition to requirements specified in Section 017900, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

F. Training Manuals: See Section 017900 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.1 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.

3.2 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:
   1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
   2. Set pump/fan to normal operating mode.
   3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
   4. Command valve/damper open; verify position is full open and adjust output signal as required.
   5. Command valve/damper to a few intermediate positions.
   6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.
   1. With full pressure in the system, command valve closed.
   2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.3 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.4 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
   1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
   2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
   1. Setpoint changing features and functions.
   2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
   1. That all specified functions and features are set up, debugged and fully operable.
   2. That scheduling features are fully functional and setup, including holidays.
   3. That all graphic screens and value readouts are completed.
   4. Correct date and time setting in central computer.

5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.5 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.6 DEMONSTRATION AND TRAINING

A. See Section 017900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct Owner's personnel for minimum ____ hours, after completion of TAB, on the following:
1. Review final TAB report, explaining the layout and meanings of each data type.

2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
1. Phase 1 - Basic Control System: Provide minimum of ____ hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
   a. This training may be held on-site or at the manufacturer's facility.
   b. If held off-site, the training may occur prior to final completion of the system installation.
   c. For off-site training, Contractor shall pay expenses of up to two attendees.
2. Phase 2 - Integrating with HVAC Systems: Provide minimum of ____ hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
   a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
   b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
   c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
   d. Every display screen, allowing time for questions.
   e. Point database entry and modifications.
3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of ____ hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 230913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 2 PRODUCTS

1.1 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

END OF SECTION

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SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.2 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.2 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.

B. Flanges for Pipe Size Over 1 Inch (25 mm):
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2.3 BALL VALVES

A. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, brass, bronze, or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blowout proof stem, lever handle with balancing stops, solder, threaded, or grooved ends with union.

2.4 PLUG VALVES

A. Construction 2-1/2 Inches (65 mm) and Larger: MSS SP-78, 175 psi (1200 kPa) CWP, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 230516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

H. Provide access where valves and fittings are not exposed.

I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior piping systems and components is specified in Section 099123.
   2. Painting of exterior piping systems and components is specified in Section 099113.

J. Install valves with stems upright or horizontal, not inverted.

K. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

L. Sleeve pipes passing through partitions, walls and floors.

M. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
   4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 230548.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for throttling, bypass, or manual flow control services.

D. Provide plug valves in natural gas systems for shut-off service.

3.5 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches (15 mm) to 1-1/4 inches (32 mm):
         1) Maximum Hanger Spacing: 6.5 ft (2 m).
         2) Hanger Rod Diameter: 3/8 inches (9 mm).
      b. Pipe Size: 1-1/2 inches (40 mm) to 2 inches (50 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).
      c. Pipe Size: 2-1/2 inches (65 mm) to 3 inches (75 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 1/2 inch (13 mm).
      d. Pipe Size: 4 inches (100 mm) to 6 inches (150 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 5/8 inch (15 mm).

END OF SECTION

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SECTION 232113 - HYDRONIC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

C. Equipment drains and overflows.

D. Pipe hangers and supports.

E. Unions, flanges, mechanical couplings, and dielectric connections.

F. Valves:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.

G. Flow controls.

1.2 SUBMITTALS

A. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

B. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturers catalog information.
   3. Indicate valve data and ratings.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum 6 years of documented experience.

B. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

C. Welder Qualifications: Certify in accordance with ASME BPVC-IX.
   1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary protective coating on cast iron and steel valves.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
   1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
   2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
   3. Grooved mechanical joints may be used in accessible locations only.
      a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
      b. Grooved mechanical connections and joints comply with AWWA C606.
         1) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
      c. Use rigid joints unless otherwise indicated.
      d. Use gaskets of molded synthetic rubber with central cavity, pressure-responsive configuration, and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F (110 degrees C) or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F (93 degrees C).
   4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:
   1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch (20 mm) gate valves with cap; pipe to nearest floor drain.
   2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings. (ball to 1.5", butterfly for 2" and above)
   3. For throttling, bypass, or manual flow control services, use globe or ball valves.
   4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.2 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
   2. Threaded Joints: ASME B16.3, malleable iron fittings.
   3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L, drawn, using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
      a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
3. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.51, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.3 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

B. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
   1. Fittings: ASTM D2466 or D2467, PVC.
   2. Joints: Solvent welded in accordance with ASTM D2855.

C. ABS Pipe: ASTM D2680.
   1. Fittings: Compatible with piping material.
   2. Joints: Solvent welded with ASTM D2235 cement.

2.4 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
   3. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Greater: Adjustable steel yoke, cast iron roll, double hanger.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
   7. Wall Support for Pipe Sizes 4 Inches (100 mm) and Greater: Welded steel bracket and wrought steel clamp.
   8. Vertical Support: Steel riser clamp.
   9. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   11. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   12. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.5 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches (50 mm, DN) and Less:

1. Ferrous Piping: 150 psi (1034 kPa) brass or malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches (50 mm, DN) and Greater:
1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
2. Copper Piping: Bronze.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

D. Dielectric Connections:
1. Waterways:
a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
b. Dry insulation barrier able to withstand 600-volt breakdown test.
c. Construct of galvanized steel with threaded end connections to match connecting piping.
d. Suitable for the required operating pressures and temperatures.
2. Flanges:
a. Dielectric flanges with same pressure ratings as standard flanges.
b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
c. Dry insulation barrier able to withstand 600-volt breakdown test.
d. Construct of galvanized steel with threaded end connections to match connecting piping.
e. Suitable for the required operating pressures and temperatures.
3. Unions:
a. 1/2 to 1 Inches (15 to 25 mm): Brass solder to galvanized FPT.
b. 1/2 to 2 Inches (15 to 50 mm): Brass solder to galvanized FPT.
c. 1/2 to 1 Inches (15 to 25 mm): Brass to galvanized FPT or FIP (Female Iron Pipe).
d. 3/4 to 1/2 Inch (20 to 15 mm) Reducer: Brass solder to galvanized FPT.
e. Service: 250 psi (1,723.6 kPa), minus 20 to 180 deg F (minus 28.9 to 82.2 deg F).

2.6 BALL VALVES

A. Manufacturers:
1. Anvil International: www.anvilintl.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Grinnell Products: www.grinnell.com/#sle.
4. Milwaukee Valve Company: www.milwaukeevalve.com/#sle.
5. Victaulic Company: www.victaulic.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Up To and Including 2 Inches (50 mm):
1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

C. Over 2 Inches (50 mm):
   1. Ductile iron body, chrome plated stainless steel ball, teflon or Virgin TFE seat and stuffing box seals, lever handle or gear operated, flanged ends, rated to 800 psi (5515 kPa).

2.7 BUTTERFLY VALVES

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Grinnell Products: www.grinnell.com/#sle.
   4. Milwaukee Valve Company: www.milwaukeevalve.com/#sle.
   5. Victaulic Company: www.victaulic.com/#sle.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

C. Disc: Construct of aluminum bronze or chrome plated ductile iron.

D. Operator: 10 position lever handle.

2.8 SWING CHECK VALVES

A. Manufacturers:
   1. Anvil International: www.anvilintl.com/#sle.
   2. Apollo Valves: www.apollovalves.com/#sle.
   3. Grinnell Products: www.grinnell.com/#sle.
   4. Milwaukee Valve Company: www.milwaukeevalve.com/#sle.
   5. Victaulic Company: www.victaulic.com/#sle.

B. Up To and Including 2 Inches (50 mm):
   1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

C. Over 2 Inches (50 mm):
   1. Iron body, bronze trim, bronze swing disc, renewable disc and seat, flanged or grooved ends.

2.9 FLOW CONTROLS

A. Manufacturers:
   1. Bell & Gossett, a brand of Xylem, Inc; _____: www.bellgossett.com/#sle.
   2. Griswold Controls; _____: www.griswoldcontrols.com/#sle.
   3. ITT Bell & Gossett; _____: www.bellgossett.com/#sle.
   4. Victaulic Company; _____: www.victaulic.com/#sle.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 10 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, minimum pressure 2 psi (13.7 kPa).

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. See Section 232500 for additional requirements.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interference with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls, and floors.

G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

H. Slope piping and arrange to drain at low points.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 230516.

J. Grooved Joints:
   1. Install in accordance with the manufacturer's latest published installation instructions.
   2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

K. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
   4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   5. Use hangers with 1-1/2 inches (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping.
   9. Prime coat exposed steel hangers and supports. See Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 230719.

M. Provide access where valves and fittings are not exposed.

N. Install valves with stems upright or horizontal, not inverted.

3.3 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 Inch (15 mm) and 3/4 inch (20 mm): Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1 Inch (25 mm): Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6 mm).
   3. 1-1/2 Inches (40 mm) and 2 Inches (50 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2-1/2 Inches (65 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   5. 3 Inches (80 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
   6. 4 Inches (100 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 1/2 inch (13 mm).

B. Hanger Spacing for Steel Piping.
   1. 1/2 Inch (15 mm), 3/4 Inch (20 mm), and 1 Inch (25 mm): Maximum span, 7 feet (2100 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1-1/4 Inches (32 mm): Maximum span, 8 feet (2400 mm); minimum rod size, 3/8 inch (9 mm).
   3. 1-1/2 Inches (40 mm): Maximum span, 9 feet (2700 mm); minimum rod size, 3/8 inch (9 mm).
   4. 2 Inches (50 mm): Maximum span, 10 feet (3.0 m); minimum rod size, 3/8 inch (9 mm).
   5. 2-1/2 Inches (65 mm): Maximum span, 11 feet (3.4 m); minimum rod size, 3/8 inch (9 mm).
   6. 3 Inches (80 mm): Maximum span, 12 feet (3.6 m); minimum rod size, 3/8 inch (9 mm).
   7. 4 Inches (100 mm): Maximum span, 14 feet (4.3 m); minimum rod size, 1/2 inch (13 mm).

END OF SECTION

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SECTION 232114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

B. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of flow controls.

E. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimuM 6 years of documented experience.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1 EXPANSION TANKS

A. Manufacturers:
   1. Amtrol Inc; _____: www.amtrol.com/#sle.
   2. Bell & Gossett, a brand of Xylem, Inc; _____: www.bellgossett.com/#sle.
   3. Taco, Inc; _____: www.taco-hvac.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Acceptance Volume Capacity: see drawings.

C. Maximum Rated Working Pressure: see drawings

D. Maximum Allowable Service Temperature: 240 degrees F (115.6 degrees C).

E. Construction: as specified on drawings

F. Automatic Cold Water Fill Assembly: as specified on drawings

2.2 AIR VENTS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com/#sle.
   2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   3. Nexus Valve, Inc: www.nexusvalve.com/#sle.
   4. Taco, Inc: www.taco-hvac.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Manual Air Vent: Short vertical sections of 2-inch (50 mm, DN) diameter pipe to form air chamber, with 1/8 inch (6 mm, DN) brass needle valve at top of chamber.

C. Float Air Vent:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

D. Hygroscopic Air Vent:
   1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.

E. Maximum Fluid Pressure: 150 psi (1,034 kPa).

F. Maximum Fluid Temperature: 250 degrees F (121.1 degrees C).

2.3 HYDRAULIC SEPARATORS

A. Hydraulic Separator:
   1. Manufacturers:
      a. Substitutions: See Section 016000 - Product Requirements.
   2. Full flow coalescing type hydraulic separator shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include three performance chambers within the vessel. One chamber above the higher nozzle set for air elimination, one below the lower nozzle set for dirt separation, and one between the nozzles for hydraulic separation.
   3. Selection shall be based upon system flows with pipe size as a minimum.
   4. Unit shall include internal structured elements filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100% free air, 100% entrained air, and 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. The elements must be fabricated by the manufacturer and consist of a copper core tube with continuous wound copper wire medium permanently attached and followed by a separate continuous wound copper wire permanently affixed.
   5. Each unit shall have a separate venting chamber to prevent system contaminants from harming the float and venting valve operation. At the top of the venting chamber shall be an integral full port float actuated brass venting mechanism.

2.4 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com/#sle.
   2. Grinnell Products: www.grinnell.com/#sle.
   3. The Metraflex Company; LPD Y Strainer: www.metraflex.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Size 2 inch (50 mm, DN) and Under:
   1. Provide threaded, grooved, or sweat brass or iron body for up to 175 psi (1,200 kPa) working pressure, Y-pattern strainer with 1/32 inch (0.8 mm) stainless steel perforated screen.
   2. Body Material by Fluid Service:
      a. Cast Iron or Brass:

1) Steam: Up to 250 psi at 450 degrees F (1,723.6 kPa at 232.2 degrees C).
2) Liquids: Up to 400 psi at 150 degrees F (2,758 kPa at 65.6 degrees C).

C. Size 2-1/2 inch (65 mm, DN) to 4 inch (100 mm, DN):
1. Provide flanged or grooved iron body for up to 175 psi (1,200 kPa) working pressure, up to 250 degrees F (121.1 degrees C) working temperature, Y-pattern strainer with 1/16 inch (1.6 mm) or 3/64 inch (1.2 mm) stainless steel perforated screen.
2. Body Material by Fluid Service:
a. Cast Iron:
1) Steam: Up to 125 psi at 350 degrees F (861.8 kPa at 51.7 degrees C).
2) Liquids: Up to 200 psi at 150 degrees F (1,379 kPa at 65.6 degrees C).

D. Size 5 inch (125 mm, DN) and Larger:
1. Provide flanged or grooved iron body for up to 175 psi (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.
2. Liquid Fluid Service: Up to 285 psi at 100 degrees F (1,965 kPa at 37.8 degrees C).

E. Basket-Type, Size 1 to 30 inch (25 to 750 mm, DN) for Liquid Service:
1. Flanged carbon steel body with 1/8 inch (3.2 mm) stainless steel perforated basket screen, bottom drain and capped air vent.
2. Fluid Service: Up to 285 psi at 100 degrees F (1,965 kPa at 37.8 degrees C).

F. Accessories: Provide air vent, hanging tag, outlet ball valve, and PT test plug extension.

2.5 PUMP CONNECTORS

A. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
1. Maximum Operating Service: 150 psi (1030 kPa) at 240 degrees F (115.6 degrees C).
2. Accommodate the Following:
a. Axial Deflection in Compression and Expansion:.
b. Lateral Movement: .
c. Angular Rotation: 15 degrees.
d. Force developed by 1.5 times specified maximum allowable operating pressure.
3. End Connections: Same as specified for pipe jointing.
4. Provide pump connector with integral vanes to reduce turbulent flow.
5. Provide necessary accessories including, but not limited to, swivel joints.

2.6 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:
1. Anvil International: www.anvilintl.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
3. Taco, Inc: www.taco-hvac.com/#sle.
4. Victaulic Company of America; _____: www.victaulic.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. Class 125:
1. Maximum Service Operation: 175 psi (1,200 kPa) at 250 deg. F..

C. Quarter-Turn Plug Type: Flanged cast-iron body with bolt-on bonnet, position indicator, stainless steel stem, backflow preventer, memory stop, metering connectors, bubble-tight shutoff, and wrench-adjustable plug flow regulator.

D. Triple-Duty Globe Type: Grooved cast-iron angle pattern body with bolt-on bonnet, position indicator, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, metering connectors, flow shutoff mechanism, and adjustable flow handle.

2.7 PRESSURE-TEMPERATURE TEST PLUGS

A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F (93 degrees C).

B. Application: Use extended length plugs to clear insulated piping.

2.8 BALANCING VALVES

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com/#sle.
2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
3. Nexus Valve, Inc: www.nexusvalve.com/#sle.
4. Taco, Inc: www.taco-hvac.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. Size 2 inch (50 mm, DN) and Smaller:
1. Provide ball style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and female sweat, NPT threaded, press, or soldered connections.
2. Metal construction materials consist of bronze body, brass ball construction with glass and carbon filled TFE seat rings. .
3. Non-metal construction materials consist of Teflon.
4. Maximum Service Operation: 300 psi at 250 degrees F (2,068 kPa at 121.1 degrees C).

C. Size 2-1/2 inch (65 mm, DN) and Larger:
1. Provide ball style with flow balancing, shut-off capabilities, memory stops, and minimum of two metering ports and flanged, grooved, or weld-end connections.
2. Valve body construction materials same as 2" and smaller.
3. Internal components construction materials same as 2" and smaller, except with RS55 high temperature resilient plug seal.
4. Maximum Service Operation: 175 psi at 250 degrees F (1,200 kPa at 121.1 degrees C).

2.9 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 PRESSURE REDUCING VALVES

A. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 232113. (Required only if glycol feed tank and system is not utilized. See drawings.

B. Materials of Construction:
1. Valve Body: Constructed of bronze.

2. Internal Components: Construct of bronze.

C. Connections:
1. NPT threaded: 1/2 inch (15 mm, DN) or 3/4inch (20 mm, DN).
2. Soldered: 1/2 inch (15 mm, DN).

D. Provide integral check valve and strainer.

E. Maximum Inlet Pressure: 400 psi (2,758 kPa).

F. Maximum Fluid Temperature: 180 degrees F (82 degrees C).

G. Adjustable Pressure Range: From 10 to 45 psi (69 to 310.3 kPa), set to 25 psi (172 kPa).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Where large air quantities can accumulate, provide enlarged air collection standpipes.

C. Provide manual air vents at system high points and as indicated.

D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

E. Provide air separator on suction side of system circulation pump and connect to expansion tank.

F. Provide valved drain and hose connection on strainer blowdown connection.

G. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

H. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

I. Pipe relief valve outlet to nearest floor drain.

END OF SECTION

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SECTION 232123 - HYDRONIC PUMPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Circulators.

B. In-line pumps.

1.2 SUBMITTALS

A. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Fluid Technology, Inc; _____: www.armstrongfluidtechnology.com/#sle.

B. Bell & Gossett, a Xylem Inc. brand; _____: www.bellgossett.com/#sle.

C. Grundfos Pumps Corporation; _____: www.grundfos.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.2 GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

B. Electrical Requirements:

1. Listed and classified by UL or testing agency acceptable to authority having jurisdiction as suitable for the purpose specified and indicated.
2. Variable Frequency Drives (VFDs): Provide in accordance with Section 230934, except for integral-VFDs.
3. Enclosures: Provide unspecified product(s) required to fit motor:

2.3 CIRCULATORS

A. Horizontal shaft, single-stage pump with direct connected, resilient-mount, oil lubricated motor for discharge pressures of up to 125 psi (860 kPa).

B. Casing: Cast iron, with flanged pump connections.

C. Impeller: Non-ferrous keyed to shaft.

D. Bearings: Oil-lubricated bronze sleeve.

E. Shaft: Stainless steel, integral thrust collar.

F. Drive: Flexible coupling.

G. Electrical:

1. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.4 IN-LINE PUMPS

A. Casing: Cast iron with seal flush connection, threaded suction, and discharge ports with gauge port and drain plug.

B. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.

C. Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.

D. Seal: Manufacturer's standard seal, 225 degrees F (107 degrees C) maximum continuous duty temperature.

E. Electrical:
   1. Integral Controls:
      a. Variable Frequency Drive (VFD): Factory-fitted and tested with dedicated terminal box for power, instrumentation and related control wiring.
      b. DDC Controller: VFD-integrated or external controller module with visual-tactile interface and minimum of 2 analog inputs, 2 digital inputs, and real-time clock. Provide differential pressure sensor and temperature sensor with thermowell and thermal grease.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Provide line sized shut-off valve and strainer on pump suction, and line sized combination pump discharge valve on pump discharge.

END OF SECTION

SECTION 232500 - HVAC WATER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials.
   1. Closed system treatment (water).

B. By-pass (pot) feeder.

1.2 SUBMITTALS

A. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

C. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years experience and approved by manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

2.2 BY-PASS (POT) FEEDER

A. 2 quart (1.9 L) quick opening cap for working pressure of 175 psi (1200 kPa).

PART 3 EXECUTION

3.1 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.3 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. Provide 3/4 inch (19 mm) water coupon rack around circulating pumps with space for 4 test specimens.

END OF SECTION

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.2 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 230713 - Duct Insulation: External insulation and duct liner.

C. Section 233300 - Air Duct Accessories.

D. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.3 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

H. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

I. SMACNA (RIDC) - Rectangular Industrial Duct Construction Standards; 2024.

J. SMACNA (ROUND) - Round Industrial Duct Construction Standards; 2013.

K. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fitting types, gauges, sizes, welds, and configuration.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 6 years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 6 years of documented experience.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated.

C. Acoustical Treatment: Provide sound-absorbing liners for metal-based ducts in compliance with Section 233319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc (500 Pa) of galvanized steel.
   2. Rectangular: Plus or minus 2 in-wc (500 Pa) of galvanized steel.
   3. Flat Oval: Plus 2 in-wc (500 Pa) of galvanized steel.
   4. Flexible Duct (Fabric and wire): Plus or minus 2 in-wc (500 Pa); see Section 233700.

E. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Low Pressure Service: Up to 2 in-wc (500 Pa):
      a. Seal: Class C, apply to seal off transverse joints.
      b. Leakage:
         1) Rectangular: Class 24 or 24 cfm/100 sq ft (680 Lpm/9.3 sq m).
         2) Round: Class 12 or 12 cfm/100 sq ft (340 Lpm/9.3 sq m).

F. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
   3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   4. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide turning vanes of perforated metal .
   5. Provide turning vanes of perforated metal when acoustical lining is indicated.
   6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
   7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide transition fitting, blank-out panels sealing louver area around duct are not allowed.

2.2 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
   2. Aluminum: ASTM B209/B209M, aluminum sheet, alloy 3003-H14.
   3. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

B. Round Spiral Duct:
   1. Round spiral lock seam duct with galvanized steel outer wall.
   2. Manufacturers:

C. Connectors, Fittings, Sealants, and Miscellaneous:
   1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
   2. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
      b. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

2.3 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form spiral helix.
   1. Pressure Rating: 10 in-wc (2.50 kPa) positive and 5 in-wc (1.25 kPa) negative.
   2. Maximum Velocity: 5500 fpm (27.9 m/sec).
   3. Temperature Range: Minus 20 degrees F to 250 degrees F (Minus 28 degrees C to 121 degrees C).

B. Flexible Air Ducts:
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: From 10 in-wc (2.50 kPa) to 5 in-wc (1.25 kPa) negative.
   3. Maximum Velocity: 5,500 fpm (27.9 m/s).
   4. Temperature Range: Minus 20 to 250 degrees F (Minus 28 to 121 degrees C).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Flexible Ducts: Connect to metal ducts with draw bands.

G. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

K. Fire Partitions: Provide firestopping sealing. See Section 078400.

L. Duct Insulation: Provide duct insulation. See Section 230713.

END OF SECTION

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SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air turning devices/extractors.

B. Duct access doors.

C. Duct test holes.

D. Flexible duct connectors.

E. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

C. Project Record Drawings: Record actual locations of access doors and test holes.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

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. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com/#sle.
2. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
3. Krueger-HVAC, Division of Air System Components: www.krueger-hvac.com/#sle.
4. Ruskin Company: www.ruskin.com/#sle.
5. Titus HVAC, a brand of Johnson Controls: www.titus-hvac.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.2 DUCT ACCESS DOORS

A. Manufacturers:
   1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   4. Lloyd Industries, Inc: www.firedamper.com/#sle.
   5. Nailor Industries, Inc: www.nailor.com/#sle.
   6. Ruskin Company: www.ruskin.com/#sle.
   7. SEMCO LLC: www.semcohvac.com/#sle.
   8. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch (25 mm) thick insulation with sheet metal cover.
   1. Less Than 12 inches (300 mm) Square: Secure with sash locks.
   2. Up to 18 inches (450 mm) Square: Provide two hinges and two sash locks.
   3. Up to 24 by 48 inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Provide an additional hinge.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.3 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.4 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.5 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com/#sle.
   2. Nailor Industries, Inc: www.nailor.com/#sle.
   3. Pottorff; _____: www.pottorff.com/#sle.
   4. Ruskin Company: www.ruskin.com/#sle.
   5. United Enertech: www.unitedenertech.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
   2. Blade: 24 gauge, 0.0239 inch (0.61 mm), minimum.

D. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches (200 by 1825 mm). Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
   1. Blade: 18 gauge, 0.0478 inch (1.21 mm), minimum.

E. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

F. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch (200 by 200 mm) size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch (100 by 100 mm) size access door for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

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SECTION 233416 - CENTRIFUGAL HVAC FANS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point plotted, power, rpm, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.5 FIELD CONDITIONS

A. Permanent fans may not be used for ventilation during construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Greenheck: www.greenheck.com/#sle.

B. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

C. Substitutions: See Section 016000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Fabrication: Comply with AMCA 99.

2.3 WHEEL AND INLET

2.4 BEARINGS AND DRIVES

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide backdraft dampers on exhaust fans located at discharge side; see Section 233300.

END OF SECTION

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cabinet exhaust fans.

B. Ceiling exhaust fans.

1.2 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 233300 - Air Duct Accessories: Backdraft dampers.

1.3 REFERENCE STANDARDS

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 CABINET AND CEILING EXHAUST FANS

A. Manufacturers:
   1. Greenheck Fan Corporation; _____: www.greenheck.com/#sle.
   2. Loren Cook Company: www.lorencook.com/#sle.

B. Centrifugal Fan Unit: direct driven with galvanized steel housing, resiliently mounted motor, gravity backdraft damper in discharge.

C. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor.

D. Grille: Molded white plastic.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads.
   2. Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum 1 inch (25 mm) flex between ductwork and fan while running.

C. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

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SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

1.2 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

I. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.4 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 6 years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Krueger-HVAC: www.krueger-hvac.com/#sle.

C. Metalaire, a brand of Metal Industries Inc: www.metalaire.com/#sle.

D. Price Industries: www.priceindustries.com/#sle.

E. Ruskin Company: www.ruskin.com/#sle.

F. Titus, a brand of Air Distribution Technologies; _____: www.titus-hvac.com/#sle.

G. Tuttle and Bailey: www.tuttleandbailey.com/#sle.

2.2 SPECIFIC PRODUCTS

A. See diffusers, registers and grilles schedule on the plans.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black, see Section 099123.

3.2 CLOSEOUT ACTIVITIES

A. Demonstrate operational system to Owner's representative.

B. Instruct Owner's representative to maintain system and use occupant controls or interfaces, as required.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION

SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single wall metal stacks.

B. Double wall metal stacks.

C. Special gas venting.

1.2 REFERENCE STANDARDS

A. UL 1738 - Standard for Venting Systems for Gas-Burning Appliances, Categories II, III, and IV; Current Edition, Including All Revisions.

1.3 DEFINITIONS

A. Breeching: Vent connector.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Vent: That portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

D. Vent Connector: That part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. Product Data: Provide data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements.

B. Shop Drawings: Indicate general construction, dimensions, weights, support and layout of breechings. Submit layout drawings indicating plan view and elevations where factory-built units are used.

C. Manufacturer's Instructions: Include installation instructions, and indicate assembly, support details, and connection requirements.

D. Manufacturer's Certificate: Certify that refractory lined metal stacks meet or exceed specified requirements.

E. Designer's qualification statement.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design stacks under direct supervision of a Professional Structural Engineer experienced in design of the type of work specified and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 BREECHINGS, CHIMNEYS, AND STACKS - GENERAL REQUIREMENTS

A. Regulatory Requirements:
   1. Comply with applicable codes for installation of natural gas burning appliances and equipment.
   2. Factory-built vents and chimneys used for venting natural draft appliances to comply with NFPA 211 and UL listed and labeled.

2.2 SPECIAL GAS VENTING (CATEGORY II, III, AND IV)

A. Single-Wall Special Gas Venting:
   1. Manufacturers:
      a. AMPCO; _____: www.ampcostacks.com/#sle.
      b. Selkirk Corporation; _____: www.selkirkcommercial.com/#sle.
      c. Heatfab Saf-T Vent; Model EZ Seal: www.heatfab.com/#sle.
      d. Z-Flex U.S. Inc: www.z-flex.com/#sle.
      e. _____.
   2. Provide single-wall metal stacks, tested to UL 1738 and UL listed with positive pressure rating for use with building heating equipment; comply with NFPA 54.
   3. Fabricate with 28-gauge, 0.0156-inch (0.41 mm) 29-4C stainless steel minimum.
   4. Design, fabricate, and install gastight to prevent products of combustion from leaking into building. Securely connect inner joints and seal in accordance with manufacturer's instructions.
   5. Accessories, UL Labeled:
      a. Rain/Stack Cap: Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

B. Double-Wall Special Gas Venting:
   1. Manufacturers:
      a. Selkirk Corporation; _____: www.selkirkcommercial.com/#sle.
      b. Heatfab Saf-T Vent; Model CI Plus: www.heatfab.com/#sle.
      c. Z-Flex U.S. Inc: www.z-flex.com/#sle.
   2. Provide double-wall metal stacks, tested to UL 1738 and UL listed with positive pressure rating for use with building heating equipment; comply with NFPA 54.
   3. Fabricate with 1-inch (25 mm) minimum air space between walls and construct inner liner of 28-gauge, 0.015-inch (0.41 mm) 29-4C stainless steel minimum and outer jacket of 24 gauge, 0.025-inch (0.64 mm) stainless steel minimum.
      a. Protect aluminized steel surfaces exposed to elements with minimum of one base coat of primer and one finish coat of corrosion-resistant paint suitable for outer jacket skin temperatures of application.
   4. Design, fabricate, and install gastight to prevent products of combustion from leaking into building. Securely connect inner joints and seal in accordance with manufacturer's instructions.
   5. Accessories, UL Labeled:
      a. Rain/Stack Cap: Consists of conical rainshield with inverted cone for partial rain protection with low flow resistance.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

C. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

D. Assemble and install stack sections in accordance with NFPA 82, UL Listings, and industry practices. Join sections with acid-resistant joint cement. Connect base section to foundation using anchor lugs.

E. Level and plumb chimney and stacks.

F. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

G. At appliances, provide slip joints permitting removal of appliances without removal or dismantling of breechings, breeching insulation, chimneys, or stacks.

END OF SECTION

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SECTION 235216 - FIRE-TUBE CONDENSING BOILERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes packaged, factory-fabricated and assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for space heating hot water.

1.3 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For boilers, boiler trim, and accessories.
   1. Wiring Diagrams: Power, signal, and control wiring.

C. Source quality-control test reports: Indicate and interpret test results for compliance with performance requirements before shipping.

D. Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.

E. Warranty: Standard warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. AHRI Compliance: Boilers shall be AHRI listed and must meet the minimum efficiency specified under AHRI BTS-2000 as defined by Department of Energy in 10 CFR Part 431.

E. ANSI Compliance: Boilers shall be compliant with ANSI Z21.13 test standards for US and Canada.

F. CSA Compliant: Boilers shall be compliant with CSA certification.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.7 WARRANTY

A. Standard Warranty: Boilers shall include 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 Fire-Tube Condensing Boilers:
      a. Heat Exchanger, Pressure Vessel and Condensation Collection Basin shall carry a 10 year limited warranty against defects in materials or workmanship and failure due to thermal shock.
      b. All other components shall carry a one year warranty from date of boiler start up.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Modular Condensing Hot Water Boiler for Indoor Applications:
   1. Lochinvar LLC; _____: www.lochinvar.com/#sle.
   2. AERCO International, Inc.: www.aerco.com.
   3. The Fulton Companies; _____: www.fulton.com/#sle.

2.2 CONSTRUCTION

A. Description: Boiler shall be natural gas fired, fully condensing, and fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

B. Heat Exchanger: The heater exchanger shall bear the ASME “H” stamp for 160 psi (1103.16 kPa) working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded stainless steel and of fire tube design. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Cast iron, aluminum, or condensing copper tube boilers will not be accepted.

C. Efficiency: Boilers shall have an AHRI certified minimum thermal efficiency of 97 percent.

D. Condensate Collection Basin: Fully welded stainless steel and shall include a stainless steel combustion analyzer test port.

E. Pressure Vessel: The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for a single-pass water flow to limit the water side pressure drop.

F. Burner: Natural gas, forced draft single burner premix design. The burner shall be high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency.

G. Blower: Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.
   1. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

H. Gas Train: The boiler shall be supplied with a negative pressure regulation.

I. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

J. Casing:
   1. Jacket: Heavy gauge primed and painted steel jacket with snap-in closures.
   2. Control Compartment Enclosures: NEMA 250, Type 1A.
   3. Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.
   4. Combustion-Air Connections: Inlet and vent duct collars.

2.3 TRIM

A. Safety Relief Valve:
   1. Size and Capacity: 50 lb.
   2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

B. Pressure Gage: Minimum 3-1/2 inch (89 mm) diameter. Gage shall have normal operating pressure about 50 percent of full range.

C. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.

D. Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.

2.4 CONTROLS

A. Boiler controls shall feature a standard, factory installed multi-color graphic LCD screen display with navigation dial and includes the following standard features:
   1. Con-X-Us capable: Boiler shall have the ability to communicate remotely using the optional Con-X-Us software via a wireless or Ethernet connection.
   2. Variable Speed Boiler Pump Control: Boiler may be programmed to send a 0-10V DC output signal to an ECM or VFD boiler pump to maintain a designed temperature rise across the heat exchanger. The boiler shall be able to operate in this mode with a minimum temperature rise of 30 degrees Fahrenheit (-6.67 degrees Celsius) and a maximum temperature rise of 60 degrees Fahrenheit (15.56 degrees Celsius). Project specific temperature rise shall be 30°F.
   3. Password Security: Boiler shall have a different password security code for the User and the Installer to access adjustable parameters.
   4. Outdoor air reset: Boiler shall calculate the set point using a field installed, factory supplied outdoor sensor and an adjustable reset curve.
   5. Pump exercise: Boiler shall energize any pump it controls for an adjustable time if the associated pump has been off for a time period of 24 hours.
   6. Four pump control: Boiler shall have the ability to control the boiler pump, a system pump, a domestic hot water pump, and a domestic hot water recirculation pump.
   7. Ramp delay: Boiler may be programmed to limit the firing rate based on six limits steps and six time intervals.
   8. Boost function: Boiler may be programmed to automatically increase the set point a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.
   9. Domestic hot water priority: Boiler shall make the domestic hot water call for heat a priority over any space heating call and adjust the boiler setpoint to the domestic hot water boiler setpoint.

10. Domestic hot water modulation limiting: Boiler may be programmed to limit the maximum domestic hot water firing rate to match the input rating of the indirect tank coil.
11. Domestic hot water night setback: Boiler may be programmed to reduce the domestic hot water tank set point during a certain time of the day.
12. PC port connection: Boiler shall have a PC port allowing the connection of PC boiler software.
13. Time clock: Boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.
14. Maintenance reminder: Boiler shall have the ability to display a yellow colored, customizable maintenance notification screen. All notifications are adjustable by the installer based upon months of installation, hours of operation, and number of boiler cycles.
15. English Error codes: Boiler shall have a user interface that displays a red error screen with fault codes that are displayed in English and include a date and time stamp for ease of servicing.
16. Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.
17. Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will automatically turn on. Boiler and pumps will turn off when the boiler water temperature rises above 43 degrees.
18. BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.
19. Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, space heat run hours, domestic hot water run hours and ignition attempts. All data should be visible on the boiler screen.

B. The boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. The factory installed, internal cascade controller shall include:
   1. Lead lag: The Control module shall allow only one boiler to fire at the beginning of a call for heat. Once the lead boiler is in full fire and the control calculates that additional heat is required it will call on an additional boiler as needed.
   2. Efficiency optimization: The Control module shall allow multiple boilers to simultaneously fire at minimum firing rate in lieu of Lead/Lag.
   3. Front end loading: The Control module shall allow the cascading and functional control of several non condensing Lochinvar products alongside the Knight FTXL.
   4. Rotation of lead boiler: The Control module shall change the lead boiler every hour for the first 24 hours after initializing the Cascade. Following that, the leader will be changed once every 24 hours.

C. Boiler operating controls shall include the following devices and features:
   1. Set-Point Adjust: Set points shall be fully adjustable by the installer.

2. Sequence of Operation: Factory installed controller to modulate burner firing rate to maintain system water temperature in response to call for heat.
3. Sequence of Operation: Boiler shall come standard with outdoor reset control which will control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 10 degrees Fahrenheit (-12.22 degrees Celsius) outside-air temperature, set supply-water temperature at 180 degrees Fahrenheit (82.22 degrees Celsius); at 60 degrees Fahrenheit (15.56 degrees Celsius) outside-air temperature, set supply-water temperature at 140 degrees Fahrenheit (60 degrees Celsius).

D. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation and include:
1. High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4. High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
5. Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
6. Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.
7. Optional Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for any lockout conditions.

E. Building Automation System Interface:
1. Boiler shall have the ability to receive a 0-10V system from a building management system and control by the following:
   a. 0-10V DC input to control Modulation or Setpoint
   b. 0-10V DC input from Variable speed Boiler pump
   c. 0-10V DC output signal to a Variable speed system pump
   d. 0-10V DC input Enable/Disable signal
2. Factory installed Modbus gateway interface to enable building automation system to monitor, control, and display boiler status and alarms.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

2.6 VENTING

A. Exhaust flue must be Category IV approved PVC, CPVC, PP or stainless steel sealed vent material from one of the approved manufacturers listed in the Installation and Operation manual. Boilers exhaust vent length must be able to extend to 100 equivalent feet.

B. Intake piping must be of approved material as listed in the Installation and Operations manual. Boilers intake pipe length must be able to extend to 100 equivalent feet.

C. Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.

D. Boilers using common venting must only include like models and the optional common vent damper. Contact the factory for common vent sizing.

E. Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided LCD display.

F. Refer to manufacturer's Installation and Operations manual for detailed venting instructions and approved manufacturers.

2.7 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, according to ASME Boiler and Pressure Vessel Code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
   1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in of piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Install equipment on 4" concrete housekeeping pad.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

A. Install boilers level on concrete bases. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.

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 gas piping to boiler gas-train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required.

E. Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Boiler Venting:
   1. Install flue venting kit and combustion-air intake.
   2. Connect full size to boiler connections. Comply with requirements in Division 23 Section “Breechings, Chimneys, and Stacks.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   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. Perform installation and startup checks according to manufacturer's written instructions. Complete startup form included with Boiler and return to Manufacturer as described in the 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. Occupancy Adjustments: When requested within 12 months of 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.

3.5 DEMONSTRATION

A. Engage a factory representative or a factory-authorized service representative for boiler startup. Start-up sheet shall be completed and a copy shall be sent to the Engineer and the Manufacturer. A combustion analysis shall be completed and the gas valve adjusted per the Installation and Operations manual and note in start-up report.

B. Factory representative or a factory-authorized representative shall provide Owners training to instruct maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

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SECTION 237416 - PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged, small-capacity, rooftop air-conditioning units.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place and ready for immediate installation of units.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.1 PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

A. General: Roof mounted units having gas burner and electric refrigeration that are 6 tons and smaller in capacity.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, heat exchanger and burner, heat recovery coil, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) no greater than that allowed by federal code.

2.2 CASING

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver-operated flush, cam type fasteners. Structural members to be minimum 18 gauge, 0.0478 inch (1.21 mm), with access doors or panels of minimum 20 gauge, 0.0359 inch (0.91 mm).

2.3 BURNERS

A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame-sensing device, and automatic 100 percent shutoff pilot.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

2.4 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons (21 kw) capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons (26 kw) cooling capacity and larger.

2.5 COMPRESSORS

A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

2.6 AIR FILTERS:

A. 1-inch (25 mm) thick, permanent washable.

2.7 ROOF CURBS

A. Roof Mounting Curb: 24 inches (610 mm) high, galvanized steel, channel frame with gaskets, nailer strips.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as required by manufacturer.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.3 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

END OF SECTION

SECTION 238113 - PACKAGED TERMINAL AIR-CONDITIONERS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.2 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Filters: One set for each unit.

1.3 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.4 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Ephoca; Ephoca.com.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with requirements of NFPA 90A.

END OF SECTION

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SECTION 238126.13 - SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air cooled condensing units.

B. Controls.

1.2 RELATED REQUIREMENTS

A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

1.3 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.

C. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

C. Electrical Characteristics:
   1. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 260583.

2.2 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.

B. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

C. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.

END OF SECTION

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SECTION 238200 - CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Unit ventilators.

B. Electric cabinet unit heaters.

1.2 RELATED REQUIREMENTS

A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.3 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.

B. AHRI 350 - Sound Performance Rating of Non-Ducted Indoor Air-Conditioning and Heat Pump Equipment; 2015 (Reaffirmed 2021).

C. AHRI 840 (I-P) - Performance Rating of Unit Ventilators; 2021.

D. AHRI 841 (SI) - Performance Rating of Unit Ventilators; 2021.

E. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 UNIT VENTILATORS

A. Manufacturers:
   1. Daikin Applied; _____: www.daikinapplied.com/#sle.

B. Performance Data and Safety Requirements:
   1. Unit capacities certified and tested in accordance with AHRI 840 (I-P) (AHRI 841 (SI)) and AHRI 350.
   2. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.

C. Required Directory Listings: AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI).

D. Hydronic Coils:
   1. Copper tubes mechanically expanded or bonded into evenly spaced aluminum fins.
   2. Factory pressure tested, hydrostatically, to not less than 350 psi (2,413 kPa).
   3. Provide insulated drain pan under chilled water coils, to prevent sweating, with field convertible left or right hand drain connections.

E. Cabinet: 14 gauge, 0.0747 inch (1.90 mm) sheet steel on solid base pan with exposed edges rounded. Provide removable front panels with quick-acting, key-operated cam locks. Provide removable die-cast or fabricated steel discharge grilles.

F. Finish: Factory applied baked enamel of _____ color as selected by Architect (submit color samples) on visible surfaces of enclosure or cabinet.

G. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven, arranged to draw air through coil.

H. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

I. Controls:
   1. Provide units with control valves furnished by the automatic temperature controls manufacturer.
   2. Unit Ventilator Manufacturer's Controls:
      a. Fan speed switch for unit mounting.
      b. Disconnect switch.
   3. Controls Interface:
      a. Relay board.
      b. 24-volt transformer.
   4. Provide ASHRAE Cycle I as defined in ASHRAE (HVACA) Handbook - HVAC Applications.

J. Filter: Easily removed 1 inch (25 mm) thick glass fiber throw-away type, located to filter air before coil.

K. Mixing Dampers: Multi-blade with compressible seal, capable of varying proportion of mixed air from 100 percent room air to 100 percent outside air.

2.2 ELECTRIC CABINET UNIT HEATERS

A. Manufacturers:
   1. INDEECO (Industrial Engineering and Equipment Company); _____: www.indeeco.com/#sle.
   2. Marley Engineered Products; _____: www.marleymep.com/#sle.
   3. Markel Products Company; www.markel-products.com/#sle.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.

C. Heating Elements: Provide open-wire, finned tubular, or resistance wire enclosed in steel sheath.

D. Cabinet:

1. Minimum 18 gauge, 0.0478 inch (1.21 mm) thick steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet, and inlet grilles.
2. Provide required hardware accessories for ceiling, duct, recessed, semi-recessed, surface, or wall mounting.

E. Finish:
1. Factory applied, baked enamel finish.
2. Color: As indicated on drawings.

F. Controls:
1. 2-speed fan switch.
2. Built-in line-voltage thermostat.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.2 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Do not damage equipment or finishes.

D. Unit Ventilators:
1. Locate as indicated, level and shim units, and anchor to structure.
2. Coordinate exact location of wall louvers.
3. Install shelving and auxiliary cabinetry.
4. Provide wall trim pieces for continuous wall-to-wall installation.

E. Units with Hydronic Coils:
1. Provide with shut-off valve on supply piping and tamper-proof, balancing valve with memory stop on return piping.
2. If not easily accessible, extend air vent to exterior surface of cabinet for ease of servicing.

F. Units with Electric Heating Elements:
1. Install as indicated including electrical devices furnished by manufacturer but not factory installed.
2. Install wiring in accordance with the manufacturer's wiring diagram submittal and Section 260583.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide manufacturer's field representative to test, inspect, instruct, and observe.

3.4 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. After construction and painting is completed, clean exposed surfaces of units.

C. Vacuum clean coils and inside of units.

D. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

E. Install new filters.

3.5 PROTECTION

A. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground rod electrodes.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

C. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   3. Ground Rod Electrode(s):
      a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
      b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
   4. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

G. Separately Derived System Grounding:
   1. Separately derived systems include, but are not limited to:
      a. Generators, when neutral is switched in the transfer switch.
   2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.

3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
   4. Manufacturers - Mechanical and Compression Connectors:
      a. Burndy LLC: www.burndy.com/#sle.
      b. Harger Lightning & Grounding: www.harger.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
   5. Manufacturers - Exothermic Welded Connections:
      a. Burndy LLC: www.burndy.com/#sle.
      b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

D. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.

4. Manufacturers:
   a. Harger Lightning & Grounding: www.harger.com/#sle.
   b. nVent ERICO: www.nvent.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.

D. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

1.6 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 1.3. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
   2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   3. Conduit Clamps: Bolted type unless otherwise indicated.
   4. Products:
      a. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
      b. Gripple, Inc; Fast Trak: www.gripple.com/#sle.
      c. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.
      d. Gripple, Inc; Low Profile Bracket Kits: www.gripple.com/#sle.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

D. Metal Channel/Strut Framing Systems:
1. Manufacturers:
a. ABB: www.electrification.us.abb.com/#sle.
b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
c. Eaton Corporation: www.eaton.com/#sle.
2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
3. Comply with MFMA-4.
4. Channel Material:
a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
6. Minimum Channel Dimensions: 1-5/8 inch (41 mm) wide by 13/16 inch (21 mm) high.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2-inch (13 mm) diameter.
b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch (6 mm) diameter.
c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch (10 mm) diameter.
d. Trapeze Support for Multiple Conduits: 3/8-inch (10 mm) diameter.
e. Outlet Boxes: 1/4-inch (6 mm) diameter.
f. Luminaires: 1/4-inch (6 mm) diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
b. Eaton Corporation: www.eaton.com/#sle.
c. PHP Systems/Design: www.phpsd.com/#sle.
2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

G. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
a. Dewalt: anchors.dewalt.com/#sle.
b. Hilti, Inc: www.hilti.com/#sle.
c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.

2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Dewalt: anchors.dewalt.com/#sle.
   b. Hilti, Inc: www.hilti.com/#sle.
   c. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
3. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal, fabricated supports to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 260533.13 for additional requirements.

I. Box Support and Attachment: See Section 260533.16 for additional requirements.

J. Interior Luminaire Support and Attachment: See Section 265100 for additional requirements.

K. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

L. Secure fasteners in accordance with manufacturer's recommended torque settings.

M. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

SECTION 260533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262726 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. Wall Plates: Comply with Section 262726.
13. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. E-Lids LLC: www.e-lids.com/#sle.
    c. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
    d. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
    e. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    f. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    a. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
    a. Provide hinged-cover enclosures unless otherwise indicated.
4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
5. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
1. Manufacturers:
    a. Hubbell Incorporated: www.hubbell.com/#sle.

2.2 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

1. Manufacturers:
   a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Box Locations:
   1. Locate boxes to be accessible..
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
   4. Locate boxes so that wall plates do not cross masonry joints.
   5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
   7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.

F. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

G. Install boxes plumb and level.

H. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.

I. Install boxes as required to preserve insulation integrity.

J. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

K. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

L. Close unused box openings.

M. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

N. Provide grounding and bonding in accordance with Section 260526.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

C. Section 271000 - Structured Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

C. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Switchboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location.
         4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device.
      c. Enclosed switches, circuit breakers, and motor controllers:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
      d. Transfer Switches:
         1) Identify voltage and phase.
         2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
         3) Identify load(s) served. Include location when not within sight of equipment.
         4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
   2. Service Equipment:
      a. Use identification nameplate to identify each service disconnecting means.
   3. Emergency System Equipment:
      a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
      b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
   4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
   5. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
      a. Service equipment.
   6. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards.

a. Minimum Size: 3.5 by 5 inches (89 mm by 127 mm).
b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
c. Service Equipment: Include the following information in accordance with NFPA 70.
    1) Nominal system voltage.
    2) Date label applied.

7. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    a. At each source and load connection.
    b. Within boxes when more than one circuit is present.

D. Identification for Raceways:
1. Use identification labels to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).
2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
    a. Maximum Intervals: 20 feet (6.1 m).
    b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
        1) Field-Painting: Comply with Section 099123 and 099113.
        2) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
    c. Color Code:
        1) Fire Alarm System: Red.
3. Use underground warning tape to identify underground raceways.

E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

F. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 271000.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Use identification label to identify fire alarm system devices.
4. Use identification label to identify serving branch circuit for all receptacles.

G. Identification for Luminaires:
   1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Manufacturers:
      a. Brimar Industries, Inc: www.brimar.com/#sle.
      b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
      c. Seton Identification Products: www.seton.com/#sle.
   2. Materials:
      a. Indoor Clean, Dry Locations: Use plastic nameplates.
      b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
   3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
   4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
   6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Manufacturers:
      a. Brady Corporation: www.bradyid.com/#sle.
      b. Brother International Corporation: www.brother-usa.com/#sle.
      c. Panduit Corp: www.panduit.com/#sle.
   2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
   2. Legend:
      a. System designation where applicable:
         1) Fire Alarm System: Identify with text "FIRE ALARM".
      b. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. System Designation: 1 inch (25 mm).
      b. Equipment Designation: 1/2 inch (13 mm).
   5. Color:
      a. Normal Power System: White text on black background.
      b. Fire Alarm System: White text on red background.

D. Format for Caution and Warning Messages:
   1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).

2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch (13 mm).
5. Color: Black text on yellow background unless otherwise indicated.

E. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Black text on clear background.

F. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch (3 mm).

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
3. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
a. Emergency Power System: Text "EMERGENCY".

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 WARNING SIGNS AND LABELS

A. Manufacturers:
1. Brimar Industries, Inc: www.brimar.com/#sle.
2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
3. Insite Solutions, LLC: www.stop-painting.com/#sle.
4. Seton Identification Products: www.seton.com/#sle.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
1. Materials:
a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

B. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260529 - Hangers and Supports for Electrical Systems

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

E. Section 265100 - Interior Lighting.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
   2. Coordinate placement of wall switch occupancy sensors with installed door swings.
   3. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.
   4. Coordinate lighting control device product selections with luminaire characteristics; see Section 265100 and lighting fixture schedule.
   5. Notify Architect of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B. Field quality control reports.

C. Operation and Maintenance Data: Include detailed information on device programming and setup.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide five year manufacturer warranty for occupancy sensors.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for purpose intended.

B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.

2.2 OCCUPANCY SENSORS

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. Hubbell Incorporated: www.hubbell.com/#sle.
   3. Intermatic, Inc: www.intermatic.com/#sle.
   4. Legrand North America, Inc: www.legrand.us/#sle.
   5. Lutron Electronics Company, Inc: www.lutron.com/#sle.

B. General Requirements:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during adjustable turn-off delay time interval.
   5. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   6. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.

C. Wall Switch Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during delayed-off time interval.
   2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet (83.6 sq m).
      a. Products:
         1) Lutron Maestro Series; www.lutron.com/#sle.

D. Ceiling Mounted Occupancy Sensors:
   1. General Requirements:
      a. Description: Low profile occupancy sensors designed for ceiling installation.
   2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
      a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet (41.8 sq m) at mounting height of 9 feet (2.7 m), with field of view of 360 degrees.
         1) Products:
            (a) Lutron LOS-CDT Series; www.lutron.com/#sle.

E. Directional Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
   2. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within distance of 40 feet (12 m) at mounting height of 10 feet (3.1 m).

2.3 ACCESSORIES

A. Auxiliary Contacts:
   1. Comply with NEMA IA 10039.
   2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 260533.16.

C. Maintain separation of remote-control, signaling, and power-limited circuits.
   1. See manufacturer instructions and Section 260519 for control wiring conductors, wiring methods, and identification requirements.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate; see Section 262726.

H. Provide required supports; see Section 260529.

I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

J. Occupancy Sensor Locations:
   1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors minimum of 4 feet (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

3.4 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

C. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates and covers.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.

F. Section 262913 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

F. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

G. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

J. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

K. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

M. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

N. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

O. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Wiring Device Applications:
   1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
   2. Receptacles Installed in Dwelling Units: Use tamper-resistant receptacles.
   3. Provide GFCI protection for:
      a. Receptacles installed within 6 feet (1.8 m) of sinks.
      b. Receptacles installed in kitchens.

C. Wiring Device Finishes:
   1. Provide wiring device finishes as described below, unless otherwise indicated.
   2. Wiring Devices, Unless Otherwise Indicated: Color selection by Architect.
   3. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
   4. Wiring Devices Installed in Wet or Damp Locations: White with weatherproof cover.

2.2 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

2.3 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

D. Provide locator light, illuminated with load off.

E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.4 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
      a. Products:
         1) Hubbell Incorporated; EdgeConnect Series: www.hubbell.com/#sle.
   2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
      a. Products:
         1) Hubbell Incorporated; EdgeConnect Series: www.hubbell.com/#sle.
   3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

a. Products:
1) Hubbell Incorporated; EdgeConnect Series: www.hubbell.com/#sle.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
a. Products:
1) Hubbell Incorporated: www.hubbell.com/#sle.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
a. Products:
1) Hubbell Incorporated: www.hubbell.com/#sle.

F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.
a. Products:
1) Hubbell Incorporated; EdgeConnect Series: www.hubbell.com/#sle.

2.5 WALL PLATES AND COVERS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
2. Intermatic, Inc: www.intermatic.com/#sle.
3. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
4. Lutron Electronics Company, Inc: www.lutron.com/#sle.
5. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

F. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.4 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

SECTION 262816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Enclosed safety switches.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 262913 - Enclosed Controllers: Manual motor controllers.

E. Section 263600 - Transfer Switches: Automatic and non-automatic switches listed for use as transfer switch equipment.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet (2,000 m).
   2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:
   1. Products:
   2. Comply with NEMA BS 31047.
   3. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

M. Provide the following features and accessories where indicated or where required to complete installation:
   1. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

SECTION 263600 - TRANSFER SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
   1. Automatic transfer switches.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262816.16 - Enclosed Switches: Safety switches not listed for use as transfer switch equipment.

F. Section 263213 - Engine Generators: For interface with transfer switches.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA IA 10042-1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2025.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
      a. Engine Generators: See Section 263213.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

B. Source quality control test reports.

C. Maintenance contracts.

1.6 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Transfer Switches:
   1. ABB: www.electrification.us.abb.com/#sle.
   2. Eaton Corporation: www.eaton.com/#sle.
   3. Generac Power Systems: www.generac.com/industrial/#sle.
   4. Rehlko: www.powersystems.rehlko.com/#sle.
   5. Schneider Electric; ASCO Power Technologies: www.ascopower.com/#sle.
   6. Thomson Power Systems: www.thomsonps.com/#sle.

2.2 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:
   1. Utilize open transition transfer unless otherwise indicated or required.
   2. Neutral Switching (Single Phase, Three Wire and Three Phase, Four Wire Systems):
      a. Unless otherwise indicated or required, provide neutral switching:
         1) For systems with ground fault protection.
         2) Where the alternate/emergency source is a separately derived system.

D. Construction Type: Only "breaker type" (enclosed contact) transfer switches are acceptable. Do not use "contactor type" (open contact) transfer switches.

E. Basis of Design - Automatic Transfer Switch: Schneider Electric; ASCO 300 Series: www.ascopower.com/#sle.
   1. Non-Service-Entrance Switch:
      a. Frame: 30 A to 230 A; open transition only.
      b. Transition Configuration: Open-transition.
      c. Neutral Configuration: Switched neutral.
      d. Phase Poles: As indicated on drawings.
      e. Ampere Rating: As indicated on drawings.
      f. Voltage: As indicated on drawings.
      g. Enclosure: As required for installed location.
   2. Provide the following accessories:
      a. Connectivity module for remote monitoring and control and bundle including engine exerciser, event log, additional monitoring.
      b. Audible alarm with silence.

F. Comply with NEMA IA 10042-1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

H. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

I. Switching Methods:
   1. Open Transition:
      a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
   2. Neutral Switching: Use simultaneously switched neutral (break-before-make) method. Overlapping neutral method is not acceptable.
   3. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

K. Enclosures:
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   2. Finish: Manufacturer's standard unless otherwise indicated.

L. Short Circuit Current Rating:
   1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as indicated on the drawings.

M. Automatic Transfer Switches:

1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
2. Control Functions:
   a. Automatic mode.
   b. Test Mode: Simulates failure of primary/normal source.
   c. Voltage and Frequency Sensing:
      1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
      2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
      3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
   d. Outputs:
      1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
      2) Auxiliary contacts; one set(s) for each switch position.
   e. Adjustable Time Delays:
      1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
      2) Transfer to alternate/emergency source time delay.
      3) Retransfer to primary/normal source time delay.
      4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.
   f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.
   g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.
3. Status Indications:
   a. Connected to alternate/emergency source.
   b. Connected to primary/normal source.
   c. Alternate/emergency source available.
4. Automatic Sequence of Operations:
   a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.
   b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
   c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
   d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

2.3 SOURCE QUALITY CONTROL

A. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 260529.

E. Install transfer switches plumb and level.

F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify transfer switches and associated system wiring in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. Prepare and start system in accordance with manufacturer's instructions.

B. Automatic Transfer Switches:
   1. Inspect and test in accordance with NETA ATS, except Section 4.
   2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.4 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.

3.6 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

3.7 MAINTENANCE

A. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

B. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

SECTION 265100 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and drivers.

1.2 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.

B. Section 260533.16 - Boxes for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260923 - Lighting Control Devices.

E. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

F. Section 265600 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

C. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.

D. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

H. UL 1598 - Luminaires; Current Edition, Including All Revisions.

I. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. As listed in the Lighting Fixture Schedule.
   3. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
   4. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
   5. KURTZON Lighting, Inc; www.kurtzon.com/#sle.
   6. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   7. Philips Lighting North America Corporation: www.lightingproducts.philips.com/#sle.
   8. RAB Lighting, Inc: www.rablighting.com/#sle.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.3 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
   1. Manufacturers:
      a. Acuity Brands, Inc: www.acuitybrands.com/#sle.
      b. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
      c. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
      d. RAB Lighting, Inc: www.rablighting.com/#sle.

2.4 BALLASTS AND DRIVERS

A. Manufacturers:
   1. Alloy LED: www.alloyled.com/#sle.
   2. General Electric Company/GE Lighting: www.gelighting.com/#sle.
   3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   4. OSRAM Sylvania, Inc: www.osram.us/ds/#sle.
   5. Philips Lighting North America Corporation: www.usa.lighting.philips.com/#sle.

B. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

C. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Wall Dimmers: See Section 262726.
   3. Product(s):
      a. Lutron Hi-Lume Premier 0.1% Constant Voltage (L3D0-Series): 3-wire and digital control; 0.1 percent dimming with Soft-On and Fade-to-Black low end performance; www.lutron.com/#sle.
      b. Lutron Hi-Lume 1% (L3D-Series): 3-wire and digital control; one percent dimming; www.lutron.com/#sle.

c. Lutron Hi-lume 1% Soft-on Fade-to-Black (LDE1-Series): Digital control; one percent dimming with Soft-On and Fade-to-Black low end performance; www.lutron.com/#sle.

2.5 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, factory finished to match luminaire or field-painted as directed.

B. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 260529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

SECTION 31 20 00 - EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes earthwork for foundations, floor slabs, miscellaneous exterior concrete, concrete and asphalt pavements, yard piping and rough site grading.

1.02 REFERENCES:

A. MDOT - Michigan Department of Transportation, "*2020 Standard Specifications for Construction".*

B. ASTM - American Society of Testing Materials, latest edition.

1.03 DEFINITIONS:

A. Maximum Density: Maximum unit weight per volume for an established material.

B. Optimum Moisture: Percentage of water at maximum density.

C. Borrow: Material required for earthwork construction in excess of the quantity of suitable material available from required excavation grading or cutting. Borrow may be necessary even though not shown on the plans.

D. Suitable Excavated Material: Mineral (inorganic) soil free of cinders, refuse, sod boulders, rocks, pavement soft or plastic clays, vegetable or other organic material capable of being compacted as specified. Moisture content has bearing on the suitability of materials to be used.

E. Granular Material: Coarse grained materials having no cohesion, which derive their resistance to displacement from internal stability.

F. Cohesive Material: Fine grained material which produces resistance to displacement by mutual attraction between particles. Clays are cohesive.

G. Rough Grade: Earth grade before placing structure or landscaping.

H. Subgrade: Earth grade upon which a pavement structure is to be placed.

I. Rock Excavation: Boulders or rock weighing 4,000 pounds (approximately one cubic yard) or more and all solid or ledge rock, slate, shale, sandstone and other hard materials that require continuous use of pneumatic tools, heavy rippers or continuous drilling and blasting for removal. Pavements are not included.

J. Proof Rolling: Applying test loads over the rough grade or subgrade surface by means of a heavy pneumatic tire roller or other approved means, to locate and permit timely correction of deficiencies likely to adversely affect performance of the pavement structure.

1.04 JOB CONDITIONS:

A. If, during progress of the work, testing indicates that materials do not meet specified requirements, remove defective work and replace at no cost.

B. Protect and preserve all public and private property including existing vegetation, landscape features, monuments within, along and adjacent to the work area.

C. Moisture content has bearing on the suitability of material to be used.
   1. The moisture content of a material may be such that its use will require extensive manipulation to achieve required compaction.
   2. It is the Contractor's responsibility to determine the economics of using or disposing and replacing of such materials.
   3. Materials determined by the Contractor to be uneconomical for use may be disposed on-site in areas approved by the Engineer and shall be replaced with other material at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Fill:
   1. Granular Material shall be MDOT 902.07, Table 902-3, Class III limited to 1.0-inch maximum size.
   2. Select Granular Material shall be MDOT 902.07, Table 902-3, Class II or IIA limited to 1.0-inch maximum size.
   3. Suitable Excavated Material: ARTICLE 1.03 DEFINITIONS.
   4. Clay Liner Material: Unified Classification CL, CH, ML, MH.

B. Topsoil: Surface soils containing organic matters and productive of plant life.

C. Pipe Bedding: Compact granular material.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Clearing and Grubbing: MDOT Sections 201 and 202.
   1. Remove trees and shrubs as required, unless otherwise indicated.
   2. Grub out all stumps and roots:
      a. To a minimum depth of 4 feet below finished grade within roadways.
      b. To a minimum depth of 2 feet below finished grade in other locations.
   3. Remove all debris from site resulting from clearing and grubbing.

B. Remove topsoil from all areas of new construction and stockpile on site in designated areas.

C. Utilities:
   1. Before starting excavation, establish location and extent of underground utilities in work area.
   2. Notify utility companies to remove and relocate lines which are in conflict with the proposed utility.

D. Protect Plantings and other features to remain as part of final landscaping.

3.02 EXCAVATION:

A. Excavate as required for construction of the work. Utilize or dispose of excavated materials as required.
   1. Protect excavation by shoring, bracing, sheet piling or other methods as required.
   2. Remove unsuitable material to firm underlying soils beneath footings, pipelines, floor slabs, paved areas and walks.

B. Preparation of Subgrade:
   1. Compact top 12 inches of subgrade under footings, slabs, pavement structure areas and walks to ninety-five percent (95%) maximum density unless otherwise specified.
   2. Compact top 12 inches under landscaped areas to eighty-five percent (85%) maximum density.

C. Utilities:
   1. Maintain, reroute or extend existing utility lines to remain in excavation area, as required.
   2. Protect utility services uncovered by excavation.
   3. Cap off, plug or seal discontinued utility services and remove from site within excavated areas.

3.03 FILL:

A. Clay Liner: Place clay liner material in layers 9.0 inches deep compacted to minimum ninety-five percent (95%) Maximum Density.

B. Landscape Areas: Place suitable excavated material or granular material in layers maximum 12 inches deep compacted to eighty-five percent (85%) maximum density.

3.04 ROUGH GRADING:

A. Rough grade to levels, profiles, contours and elevations required for finished grades and surface treatment.

B. Maintain the following rough grades:
   1. Sidewalk: 4 inches below finished grade.
   2. Floor slabs, exterior slabs and sidewalk at driveways: 6 inches below finished grade.
   3. Pavement surfaces: As shown on drawings.
   4. Landscape areas: 4 inches below finished grade to receive topsoil.

3.05 PROOF ROLL SUBGRADE SURFACE:

A. Perform two complete passes over area to receive pavement structure.

B. Correct deficiencies identified during proof rolling:
   1. Fill depressions with compacted material similar to subgrade soil.
   2. Undercut areas not providing satisfactory support for pavement structure:
      a. Fill with compact granular material.
      b. Place geotextile fabric when soil below undercut will not satisfactorily support construction equipment.

3.06 DEWATERING:

A. Provide dry excavations until structures have been placed and fill is complete.

B. Provide and maintain slopes, crowns, ditches and ponds to ensure satisfactory surface drainage at all times.
   1. Construct ditches and other drainage facilities necessary to remove ponded water as soon as practical to provide dry work areas for progression of the work.
   2. Interruption of surface drainage or underdrainage: Provide temporary drainage facilities until permanent drainage work complete.

3.07 COMPACTION:

A. Place and compact all required materials and provide proper control of moisture content of the material and other details necessary to obtain satisfactory results.
   1. Remove materials that cannot be compacted with manipulation and moisture control.
   2. Replace with suitable excavated material or granular material at no additional cost.

B. Correct any deficiencies resulting from insufficient or improper compaction. Retest if required.

C. Provide equipment and personnel for access to test locations.

D. Moisture - Density Relationship:
   1. Cohesive (Clays) or Granular (Sands) Soils: ASTM D1557 (Modified Proctor).
   2. Granular (Sands) Soils: Michigan Cone Test.

E. Testing will be by ENGINEER or OWNER approved independent laboratory.

3.08 SURPLUS MATERIALS:

A. Dispose of surplus or unsuitable materials on-site in areas designated by Owner.

B. Disposal On-Site: In accordance with MDOT 201.03.A.4.

END OF SECTION

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes construction of new concrete pavements and reconstruction of existing pavements with concrete pavement and related work.

B. Definitions:
1. Pavement Structure: Any combination of subbase, base course and surface course, including shoulders, placed on subgrade.
2. Permanent pavement: All improved pavement surfaces above the quality of treated or untreated gravel.
3. Subgrade: That portion of the earth grade upon which the pavement structure is to be placed.
4. Subbase: The layer of specified material of designed thickness placed on the subgrade as a part of the pavement structure.
5. Base Course: The layer of specified material of designated thickness placed on a subbase or subgrade to support the surface course.
6. Surface Course: The top layer of a pavement structure.
7. Maximum density (soils): Maximum unit weight of soil material according to Modified Proctor Method ASTM D1557.

1.02 REFERENCES:

A. MDOT - Michigan Department of Transportation, *"2020 Standard Specifications for Construction".*

B. ASTM - American Society of Testing Materials, latest edition.

1.03 SUBMITTALS:

A. Pre-Construction:
1. Concrete Mix Designs:
a. Provide a concrete mix design for each mix of concrete meeting the requirements of MDOT Division 10, prepared by independent lab, two weeks prior to paving. Contractor may submit concrete mix designs previously approved by MDOT.
2. Material Certifications:
a. Provide certifications of quality by producer for the following:
1) Cement.
2) Aggregates.
3) Admixtures.
4) Curing Compound.
5) Steel Reinforcement.
6) Pavement marking materials.
3. Batch Tickets:
a. In accordance with MDOT 1001.03.A.4.

B. Post-Construction:
1. Concrete Test Specimens:

a. Contractor shall deliver acceptance cylinders to the place of inspection and testing.

1.04 JOB CONDITIONS:

A. Seasonal Limitations:
1. Removal of permanent pavement: Unless otherwise specified, execute during the period from March 15 to October 15.
2. Restoration of permanent pavement: Unless otherwise specified, execute during the period from April 15 to November 15.

B. Protect concrete from being damaged by rain. Concrete damaged by rain shall be replaced at no cost.

C. Weather Limitations:
1. Cold Weather Protection: Protect concrete from freezing until the concrete has achieved a compressive strength of at least 1000psi.

D. Clean up promptly following pavement installation.

E. Maintenance of Temporary Surfaces: Maintain temporary surfaces until permanent pavement installation is completed.

F. Driveway Closing: Twenty-four (24) hour maximum. Provide proper notice to property owner.

G. Allow access to the concrete plant for verification of mix proportions and aggregate gradations.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Subbase: Granular material Class II, MDOT 902.07, Table 902-3.

B. Aggregate Base: Aggregate 22A unless otherwise specified. MDOT 302.02 and 902.05.

C. Maintenance Gravel:
1. Aggregate 21A, 21AA, 22A, 23A.
2. Salvaged aggregate or HMA millings.

D. Pavement Marking: MDOT 920.01.

E. Concrete:
1. Use Concrete Grade 3500 per MDOT Section 1004.
2. Use Concrete Grade P-NC per MDOT Section 1006 where indicated on drawings to achieve early compressive strength.

F. Curing Compound:
1. Provide white membrane curing compound MDOT 903.06, unless otherwise noted.

G. Chemical admixtures: MDOT Section 903.
1. Use of Calcium Chloride is not allowed.

H. Steel Reinforcement: MDOT Section 905.

I. Joint Materials: MDOT Section 914.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Removal: Remove all existing pavement structure as required, as shown on the drawings.
   1. Pavement remnant limit: Remove pavement or similar structures to existing joint, where dimension is less than 3 feet.
   2. Provide saw cut joint full depth at removal limit.
   3. Restore existing permanent pavement disturbed by construction equipment at no additional cost.

B. Dispose of all material removed during the construction.

C. Subgrade:
   1. Obtain approval prior to placing the subbase or aggregate base.
   2. Construct to the required line, grade and cross section. MDOT 205.03.N.
      a. Tolerance if subbase is required: Trim within 1 inch of design grade.
      b. Tolerance if subbase is not required: Trim within ¾ inch of design grade.
   3. Compaction:
      a. Compact to not less than ninety percent (90%) of the maximum density according to the Modified Proctor Method ASTM D1557.
      b. Compact to not less than ninety-five percent (95%) of the maximum density using the Michigan Cone Test.

D. Excavation: Conform to MDOT 205.03.G.

E. Embankment: Conform to MDOT 205.03.H and 205.03.I.

3.02 PERFORMANCE:

A. Subbase:
   1. Thickness: Conform to design cross section.
   2. Construction method:
      a. Place in equal layers not exceeding 15 inches loose measure.
      b. Spread evenly and compact to not less than ninety-five percent (95%) maximum density according to Michigan Sand Cone Test.
   3. Tolerance: Construct subbase to plan grade within a tolerance of ± 0.5 inch.

B. Aggregate Base:
   1. Thickness: Conform to design cross section.
   2. Construction Method: Conform the placing of aggregate base course with MDOT 302.03.
   3. Tolerances:
      a. Shape the aggregate base course to the design grade and cross section, within the tolerance of ±¼ inch.
      b. Check and correct grades prior to pavement placement if traffic use is allowed.

C. Concrete Pavement:
   1. Thickness: Conform to Design Cross Section.
   2. Construction Methods: Unless otherwise specified, conform paving procedures to MDOT 602.03.

3. Provide reinforcement and lane ties as indicated in the drawings.

D. Joints:
   1. Provide construction, expansion and control joints as indicated in the plans and in accordance with MDOT 602.03.
   2. Seal joints in accordance with MDOT 602.03.R and 602.03.S.

E. Pavement Markings
   1. Construction Method: MDOT 811.03.
   2. Contractor shall layout all proposed markings in accordance with the MMUTCD and MDOT Standards and as shown on the Drawings prior to placement for Owner or Owner's representative review.

3.03 TESTING AND INSPECTION:

A. Observation: By the designated authorized representative.

B. Concrete Acceptance Testing:
   1. Temperature, slump and air content: Conduct tests on the first load of concrete placed and at a minimum of once per hour of continuous pour.
      a. The temperature of the concrete shall be between 45°F and 90°F at the time of placement.
      b. Slump of the concrete shall not exceed 3.0 inches, or the slump indicated in the approved mix design.
      c. Air content at the time of placement shall be 6.5 $\pm$ 1.5 percent, unless otherwise noted.
   2. Strength: The average compressive strength of two companion cylinders shall be equal to or greater than 3,500 psi at 28 days, unless otherwise noted.
      a. Sample for strength at least once every 200 cubic yards.
      b. Concrete strength will be based on compressive strength.
      c. A single strength test consists of two cylinders.
      d. Temperature, slump and air content tests shall be run at the same time as cylinders are cast.
   3. Additional cylinders or beams may be molded and tested at the Contractors expense for early breaks and determination of concrete strength for opening to traffic or construction equipment.

C. Aggregates:
   1. Sampling and Analysis: Michigan Testing Methods, Series 100.
   2. Exception: Provide certification of approved stockpiled material.

END OF SECTION

SECTION 32 13 14 - CONCRETE SIDEWALK, SIDEWALK RAMPS AND DRIVEWAYS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes work required for concrete sidewalks, sidewalk ramps driveways.

B. Definitions:
1. Pavement Structure: The combination of the base, subbase and bituminous or concrete surface placed on the subgrade. Pavement includes gravel, bituminous and concrete surfaced streets and driveways.
2. Subgrade: The portion of the earth grade on which the concrete sidewalk is to be placed.
3. Subbase: The layer of specified material of designed thickness placed on the subgrade as a part of the pavement structure.

1.02 REFERENCES:

A. MDOT - Michigan Department of Transportation, "*2020 Standard Specifications for Construction".*

B. ASTM - American Society of Testing Materials, latest edition.

C. ADAAG – Americans with Disabilities Act Accessibility Guidelines.

D. PROWAG – Public Rights-of-Way Accessibility Guidelines

1.03 SUBMITTALS:

A. Pre-Construction:
1. Concrete Mix Designs:
a. Provide a concrete mix design for each mix of concrete meeting the requirements of MDOT Division 10, prepared by independent lab, two weeks prior to paving. Contractor may submit concrete mix designs previously approved by MDOT.
2. Material Certifications:
a. Provide certifications of quality by producer for the following:
1) Cement.
2) Aggregates.
3) Admixtures.
4) Curing Compound.
5) Steel Reinforcement.
6) Pavement marking materials.
3. Batch Tickets:
a. In accordance with MDOT 1001.03.A.4.

B. Post-Construction:
1. Concrete Test Specimens:
a. Contractor shall deliver acceptance cylinders to the place of inspection and testing.

1.04 JOB CONDITIONS:

A. General Limitations: Concrete shall not be placed between November 1 and April 1 without approval of the Owner. Concrete shall not be placed when air temperature in the shade is less than 40° F and falling. Concrete shall not be placed if portions of the base, subbase, or subgrade layers are frozen, or if the grade exhibits poor stability from excessive moisture levels. Chemicals shall not be added to reduce the freezing point. Any deviation from the above, when authorized, will require protection from freezing until the concrete has attained a compressive strength of at least 1,000 psi (1,000 psi strength will typically be attained after 2 days of curing). Concrete damaged by frost action shall be removed and replaced.

B. Clean-up promptly following sidewalk installation.

C. Maintenance of Temporary Surfaces: Maintain temporary surfaces until permanent sidewalk installation is completed.

D. Driveway Closing: 24 hours maximum for removal and replacement of concrete plus additional 96 hours (4 days) for curing. Prior to replacement, the removed portion of the driveway shall be brought up to its proposed grade with gravel and/or bituminous.

E. Protect areas under construction with lighted barricades and reflectorized fencing in accordance with applicable MDOT, MIOSHA and ASHA regulations.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Subbase: Granular material MDOT Class II, MDOT 902.07, Table 902-3.

B. Concrete:

1. Sidewalk and Sidewalk Ramps:
   a. Use Concrete Grade 3500 per MDOT Section 1004 modified to 100% limestone aggregate.
2. Driveways:
   a. Use Concrete Grade 3500 per MDOT Section 1004.
   b. Use Concrete Grade P-NC per MDOT Section 1006 where indicated on drawings to achieve early compressive strength.

C. Joint Filler: MDOT Section 914.

D. Forms: Rigid in accordance with MDOT 803.03.B, except at curved sections which shall utilize a bendable material to provide a uniform radius, supported at adequate intervals.

E. Aggregate Base: Aggregate 22A, MDOT 302.02 and 902.05.

F. Bituminous Patching: MDOT Bituminous Mix 13A, unless otherwise specified.

G. Bituminous Bond Coat: Asphalt material SS-1h. MDOT 501.02 and 904.03.C.

H. Detectable Warning Surfaces:
1. Cast ductile iron plate with anchor lugs.
2. Slip resistant textured surface.
3. Color and finish: Black asphalt dip.
4. Provide minimum 5-foot width with 2 – 30” plates.
5. Meet ADAAG.

6. Manufacturer: East Jordan Iron Works or Neenah Foundry Company.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Removal: Remove or saw cut at the existing joint in area of removal. Remove adjacent pavement structure necessary to place forms.

B. Removal of subgrade material to maintain existing sidewalk elevation and meet specified concrete thickness shall be included in the cost of the sidewalk.

C. Disposal of all removed material shall be performed by Contractor. Always keep all equipment and removed material off private property.

D. For sidewalk crossing bituminous drives: Saw cut existing bituminous and use as forms.

E. For sidewalk crossing concrete drives: Remove or saw cut at the existing joint.

F. Cut and protect tree roots.

G. Excavation: Form subgrade by trenching, excavating or filling to the required elevation.

H. If unsuitable material exists below subgrade, remove unsuitable material. If unsuitable material is removed, place a minimum 4-inch sand subbase to elevation required for bottom of concrete. In fill areas, the subbase shall be at least 1 foot wider than the sidewalk width.

I. Compact subbase to 95% maximum density.

J. Scheduling: Maximum time between removal and replacement of existing sidewalk or excavation and placement of sidewalk shall be 7 days.

K. Contractor shall notify Owner or Owner's representative of plans to pour concrete a minimum of 24-hours in advance the concrete pour. The Contractor shall provide a minimum of 2 hours between forming and pouring to allow for review. Failure to provide notice will be considered cause to reject the work.

3.02 PERFORMANCE:

A. Sidewalk and Sidewalk Ramp Requirements:
   1. All sidewalks shall be a minimum of 5 feet in width, with the grade of ¼ inch per foot from the property towards the street, unless otherwise directed.
   2. All sidewalks shall be a minimum of 4 inches thick except through driveways where they shall be a minimum of 6 inches thick for residential and 8 inches thick, with WW mesh reinforcement, for commercial / industrial. Sidewalks shall continue through commercial driveways.
   3. Sidewalk ramps shall have a uniform grade except as necessary for short grade changes and shall be in conformance with the Draft PROWAG, ADAAG and these specifications. Detectable warning surfaces shall be provided, unless otherwise directed.
   4. Sidewalk ramps shall be 6-inch thick.
   5. Detectable warning surfaces:
      a. Provide for tactile and visual warning that contrast visually with adjacent walking surfaces, either light-on-dark or dark-on-light.

b. Provide cast ductile iron detectable warning plates embedded into newly cast concrete. Provide same width as sidewalk, minimum. Install in accordance with manufacturer's recommendations, ADAAG and these specifications. Surface applied products will not be allowed. Do not construct detectable warnings by forming or stamping in newly cast concrete.
c. Provide detectable warning plates on sidewalk ramps at intersections and where the sidewalk crosses commercial driveways with curbed Detail M openings and commercial driveways that are stop-controlled.

B. Driveway Requirements:
1. Residential Driveways: 6 inches thick.
2. Commercial and Industrial Driveways: 8 inches thick.

C. Structure Adjustment: Any utility structures in the sidewalk or ramp not conforming to the finished grade shall be adjusted to grade. Conform to MDOT 403.03.C.

D. Concrete Mixing and Delivery: Transit mix concrete conforming to MDOT 1001.03.E.

E. Placing and Finishing Concrete:
1. Place concrete on a moist base in one (1) lift to the specified depth. The concrete shall be thoroughly spaded along the faces of the forms before finishing operations are started. The concrete shall be struck off to the required grade and cross section.
2. All edges and joints shall be slightly broomed transversely to roughen the surface after the concrete has received a float finish. The sidewalk ramps shall be textured with a coarse broom transversely to the ramp slope.

F. Curing and Protection:
1. Concrete shall be cured and protected as specified under MDOT Section 602.03.M and 602.03.T except that pedestrian traffic may be allowed after 48 hours if authorized. Curing compound shall be applied immediately following finishing operations.

G. Joints:
1. Joints shall be constructed to true line with their faces perpendicular to the surface of the sidewalk and shall not vary more than ¼ inch from their designated position. Transverse joints shall be constructed at right angles to centerline of the sidewalk and longitudinal joints shall be constructed parallel to the centerline unless otherwise required. When sidewalk is constructed in partial width, transverse joints shall be placed in line with like joints in the existing sidewalk.
2. The concrete at the faces of all joints shall be thoroughly spaded or vibrated and compacted to fill all voids and the surface shall be finished smooth and substantially true to grade.
3. One-half (½) inch transverse expansion joints shall be placed in line with all expansion joints in abutting curb, gutter or combination curb and gutter. When sidewalk does not abut such pavement, ½ inch transverse expansion joints shall be placed at intervals not exceeding 40 feet and at all transitions between 4 inch and 6-inch sidewalk. Expansion joint filler shall extend the full depth of the joint with the top slightly below the finished sidewalk surface. The filler shall be supported temporarily until concrete is poured against it.
4. One-half (½) inch longitudinal expansion joints shall be placed between the sidewalk and the back of abutting parallel curb or gutter, between the sidewalk and buildings, or other rigid structures.
5. One-half (½) inch expansion joints shall be placed between sidewalk approaches and the back of curb and gutter, or the edge of pavement, including bituminous driveways.

6. Contraction joints shall be placed at 5-foot intervals. They shall divide sidewalk into areas not more than 36 square feet nor less than 16 square feet. Contraction joints will be produced by slab division forms extending to the full depth of concrete or by cutting joints in the concrete after floating to a depth of not less than ¼ the thickness of the concrete. The cut joints shall not be less than 1/8-inch or more than ¼ inch in width and shall be finished smooth and substantially true to line.

H. Backfilling and bituminous patching:
   1. After concrete has gained sufficient strength (70% of design), all rails, forms, stakes and supports shall be removed in a manner as not to injure finished concrete and all exposed edges of the concrete shall be backfilled, compacted and leveled immediately.
   2. In areas where the sidewalk crosses bituminous drives, saw cut existing bituminous. Bituminous patching shall be placed and compacted.

I. Bituminous Patching:
   1. Place minimum 4 inches of aggregate base 22A and compact to ninety-five percent (95%) of maximum density.
   2. Place minimum 2 inches of MDOT Bituminous Mix 13A.

J. Concrete curb and gutter: Owner's Standard.
   1. Match existing curb and gutter.
   2. Construction methods: MDOT 802.03.

3.03 TESTING AND INSPECTION:

A. Observation: By designated authorized representative.
   1. Inspection of forms is required prior to pouring concrete.

B. Acceptance Testing:
   1. If initial testing indicates failed or nonconformance to specification, additional testing shall be paid by Contractor. Replace nonconforming material at no additional cost.

3.04 TREE ROOT CUTTING:

A. The following information shall be used as a guide when trimming tree roots:
   1. Excavate as shallow as possible in the area adjacent to the tree root.
   2. Make clean cuts with a saw or sharp chisel. Do not bury jagged or torn roots.
   3. Do not allow the exposed root ends to dry out. If exposed for more than a day, they can dry out. Cover all exposed roots with soil at the end of the day.
   4. Avoid cutting roots larger than 3.5 inches.

3.05 TREE ROOT BARRIER:

A. Install tree root barrier along the sidewalk adjacent to trees to reduce future damage by tree roots. Installation shall be in accordance with manufacturer's recommendations.

B. Install in 4-inch wide trench (with roots removed) adjacent to the sidewalk between the sidewalk and tree to a minimum depth of 30 inches. Secure with pins. Backfill carefully to avoid dislodging the barrier and compact firmly.

C. Manufacturer: Typar Biobarrier or approved equal.

3.06 SCHEDULES (See Details attached)

A. MDOT Standard Plan R-28-K CURB RAMP AND DETECTABLE WARNING DETAILS (7 sheets).

B. MDOT Standard Plan R-29-J DRIVEWAY OPENINGS AND APPROACHES, AND CONCRETE SIDEWALK (4 sheets).

END OF SECTION

SECTION 32 92 00 - SURFACE PROTECTION, RESTORATION AND TURF ESTABLISHMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. Work included in this specification consists of the establishment of a durable, permanent, weed free, mature, perennial turf and protection and restoration of site improvements.

B. Definition of Site Improvements: Fences, mailboxes, street signs, sheds, playground equipment, landscaping stones and decorations, underground lawn irrigation systems, retaining walls, parking appurtenances, and yard accessories.

1.02 REFERENCES:

A. MDOT - Michigan Department of Transportation, *"2020 Standard Specifications for Construction".*

B. MDOT – Michigan Department of Transportation, "Materials Source Guide" current edition.

C. ASTM – American Society of Testing Materials, latest edition.

1.03 SUBMITTALS:

A. Pre-Construction:
1. Topsoil test results.
2. Seed mixture.
3. Fertilizer product.
4. Herbicide product and application method

1.04 JOB REQUIREMENTS:

A. Surface Areas Disturbed by Construction Operation:
1. Restoration and Turf Establishment:
a. Fine grade to 4 inches below finished grade.
b. Remove all stones and debris greater than 1-inch diameter.
c. Place 4 inches of topsoil.
d. Rake smooth to finished grade, seed, fertilize and mulch, or place mulch blanket pegged in place, where specified or required for slope stability.
2. Place sod in areas indicated on the Drawings.

B. Site Improvements:
1. Protect all items not indicated for removal.
2. Where Site Improvements impact proposed construction, remove the item carefully, store and protect the item and reinstall the item upon completion of construction.

C. Scheduling:
1. Restoration of lawns and other surface features:
a. As soon as possible after final grading of the areas designated for turf establishment but no later than the maximum time frames stated in MDOT 208.03 or as required by project soil erosion control permit.
2. Clean up: Promptly following restoration.

D. Seasonal Limitations:
   1. MDOT 816.03.C.4.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Topsoil:
   1. Topsoil may be salvaged and reinstalled from the project site or imported to the site:
      a. Salvaged topsoil:
         1) Must be segregated during construction and kept free of intermingling with other soils.
         2) The acceptance of salvaged topsoil is subject to its ability to establish turf. The salvaged topsoil must be acceptable to the Owner and property owner after turf is established. The existing topsoil may or may not be acceptable in its existing condition.
   2. Material:
      a. Salvaged and imported topsoil:
         1) Shall be screened and amended either on-site or off-site.
         2) Shall be loose, friable, and free of refuse and foreign material.
         3) 20% minimum organic material by test method ASTM D2974.
         4) pH of 6.8 to 7.5 by test method ASTM D4972.
         5) Gradation:
            a) 100% passing the ½" sieve.
            b) 98% minimum passing the ¼" sieve.
            c) 30% maximum passing the #200 sieve.
   3. Before placing topsoil on the site, the Contractor shall have the topsoil tested by an independent soil-testing laboratory. Topsoil test results from the testing laboratory shall be submitted for review and acceptance. Tests shall include:
      a. Organic material content; ASTM D2974
      b. pH; ASTM D4972
      c. Sieve gradation analysis

B. Grass Seed Mixture:
   1. All species and their cultivars or varieties must be guaranteed hardy for Michigan.
   2. The species selected must be disease and insect resistant and of good color.
   3. Grass seed mix shall contain no more that 5% inert material by weight.
   4. The species of seed selected must be adapted for the site conditions and locations including but not limited to manicured yards.
   5. Grass Seed Mix shall be comprised of at least four of the below species and each species selected shall be 5% to 25% of the grass seed mixture by weight. At least two species selected shall be salt tolerant.
      a. Kentucky Bluegrass.
      b. Perennial Ryegrass.
      c. Hard Fescue.
      d. Creeping Red Fescue.
      e. Chewings Fescue.
      f. Turf-type Tall Fescue.
      g. Buffalo grass.
      h. Alkaligrass-Fults Puccinellia distans.

C. Chemical Fertilizer: MDOT 917.09, Class A.
   1. Phosphorus can only be used at the time of planting or when soil conditions require.

D. Hydro-mulch: MDOT 917, Recycled newsprint or wood fiber.

E. Co-polymer Gel: Finn Hydro Gel B, or equal.

F. Herbicide:
   1. Herbicides shall be furnished and applied as required to control weed growth. The Contractor shall select the herbicide and rate of application in accordance with the manufacturer's recommendations. The Contractor shall comply with all federal, state and local laws as noted in MDOT Section 107.

G. Water:
   1. Water shall be furnished and applied from an approved source. Do not draw water from any waterway (i.e. river, ditch, creek, lake, etc.)

H. Sod:
   1. MDOT 917.12.

I. Mulch Blanket:
   1. MDOT 917.14, Excelsior or straw mulch blanket listed on the current Qualified Products List in the MDOT Materials Source Guide.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Prior to construction, provide advance notice to property owners of privately-owned surface features within the project area to allow the property owner time to remove or relocate them.

B. Prior to placing topsoil, shape, compact and assure all areas to be seeded are debris and weed free. Place topsoil to a minimum depth of 4 inches and to meet proposed finished grade. If the area being restored requires more than the minimum depth of topsoil to meet finished grade, this additional depth shall be filled using topsoil. Furnishing and placing this additional material will not be paid separately.

3.02 TREES AND SHRUBS:

A. Protect all trees and shrubs during construction.

B. Where existing trees and shrubs will be impacted by construction, Contractor shall prune or trim branches in accordance with industry standard horticulture practice.

C. Tree limbs inadvertently damaged during construction shall be trimmed to remove the damaged portion within 5 days. Contractor shall notify the property owner and Owner or Owner's representative of the inadvertent damage caused and the remedy.

3.03 IRRIGATION SYSTEMS:

A. Contractor shall make every effort to protect existing irrigation systems adjacent to the project area.
B. Irrigation repair is the responsibility of the Contractor. Where existing irrigation systems are encountered during construction the Contractor shall temporarily relocate or remove as required to place the proposed improvements and repair the irrigation system promptly following construction of the improvements. This work may require cutting and capping of

the existing sprinkler lines and salvaging of the existing sprinkler heads for reuse during replacement. Where lines are cut Contractor shall take measures to prevent dirt or debris from entering the existing sprinkler lines or heads. Damaged irrigation heads shall be replaced in-kind. Acceptance of the repair subject to the approval of the property owner.

3.04 TOPSOIL:

A. Place 4 inches of topsoil in preparation of seeding.

B. Construction methods:
   1. MDOT 816.03.A.

3.05 RESTORATION NOTIFICATION TO THE PROPERTY OWNERS:

A. The Contractor shall distribute a letter to all residents at the time of seeding that states, at minimum, the following: Topsoil, grass seed, and fertilizer were placed on XX date, the minimum watering requirements that the contractor will be doing and the time frame, and it will be the responsibility of the home owner to water and maintain the grass after that time period. A copy of the letter shall be provided to the Owner and Owner's representative prior to the time that it is distributed to the residents.

3.06 HYDROSEEDING, FERTILIZING AND MULCHING:

A. Construction methods: Hydro-seed with mixture of seed, fertilizer, and mulch, and co-polymer gel with the following minimum rates:
   1. Seed:
      a. 220 pounds per acre.
   2. Fertilizer:
      a. 228 pounds per acre.
   3. Mulch:
      a. 1,200 pounds per acre of recycled newsprint or 2,000 pounds per acre of wood fiber.
   4. Co-polymer gel:
      a. 10 pounds per acre between June 1 and September 1.
      b. Zero at other times of the year.

3.07 SODDING:

A. Construction Methods:
   1. MDOT 816.

3.08 MULCH BLANKET:

A. Construction Methods:
   1. MDOT 816.

3.09 MAINTENANCE

A. Mowing:
   1. Contractor shall mow the grass prior to final acceptance.
   2. Turf shall be maintained at a visually appealing level and not more than 8 inches in height at any time prior to acceptance.

B. Weeding:

1. Weeds must be controlled to less than 10% of the turf establishment area during establishment and turf shall be weed free at time of acceptance.
2. The Contractor shall apply weed killer no sooner than recommended for newly established turf by weed control product manufacturer.

C. Watering:
1. Shall occur at minimum of twice per week for 2 months after turf establishment has been placed.
2. Amount of water shall total a combined minimum of 1.5 inches of natural rainwater, irrigation water and contractor applied water per week.

D. Repair:
1. The Contractor is responsible, at no additional cost, for the repair of turf establishment work occasioned by storm events up to 3 inches of rain in a 24-hour period as documented by local meteorological data.
2. Repairs made to damaged turf establishment areas as a result of a documented storm by a local meteorological data resulting in rainfall amounts of more than 3 inches in a 24 hr period will be paid for as an increase to the turf restoration quantity.

E. Inspections:
1. The Contractor is responsible for all inspection of turf establishment work. Provide notification to Owner or Owner's representative of upcoming inspections or maintenance work.
2. Provide a Contractor’s Daily Report to report inspections made and to document turf establishment work performed on this project.
3. Complete and submit a Contractor’s Daily Report when any work performed is in progress.
4. Include all necessary materials documentation including tests slips, certifications, etc. with the associated Contractor’s Daily Report.

3.10 ACCEPTANCE

A. Final Acceptance:
1. Before final acceptance of the turf establishment work there must be no exposed bare soil and the turf must be fully germinated, erosion free, weed free, disease free, dark green in color and in a vigorous growing condition.
2. Once growth of weed-free grass has been achieved the Contractor’s responsibility in this matter shall have ended. However, it is to be clearly understood that any failure on the part of the property owner to properly care for the restored lawn area prior to achieving a good growth of weed-free grass shall in no way relieve the Contractor of his responsibility as set forth above.

3.11 SITE IMPROVEMENTS:

A. Site Improvements damaged by contractor shall be replaced by Contractor at Contractor’s cost.

B. Unique and one-of-a-kind items damaged during construction shall be repaired, replaced or otherwise resolved by the Contractor to its owner’s satisfaction.

END OF SECTION

SECTION 33 11 00 - WATER MAINS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the work required for water mains, structures and appurtenant work installed by open-cut excavation methods.

1.02 REFERENCES:

A. AWWA - American Waterworks Association, latest edition.

B. ANSI - American National Standards Institute, latest edition.

C. ASTM - American Society of Testing Materials, latest edition.

1.03 SUBMITTALS:

A. Pre-Construction:
   1. Pipe & Fittings:
      a. Manufacturer, material & AWWA/ASTM designation.
      b. Joint construction details.
   2. Mechanically Restrained Joints:
      a. Manufacturer, model number & material.
   3. Valves & Boxes:
      a. Valve manufacturer, model number & AWWA designation.
      b. Valve box manufacturer, model number, material & dimensional drawings.
   4. Fire Hydrants:
      a. Manufacturer, model number, materials, AWWA designation.
      b. Color, nozzle sizes & barrel length.
      c. Hydrant flag manufacturer & model.
   5. Water Services:
      a. Corporation Stops:
         1) Manufacturer, model, materials, sizes & copper alloy documentation.
      b. Curb Stop & Box:
         1) Curb stop manufacturer, model, materials, sizes & copper alloy documentation.
         2) Box style, manufacturer, model & materials.
      c. Service Tubing:
         1) Material, ASTM designation & sizes.
         2) Union manufacturer, model, materials, sizes & copper alloy documentation.
   6. Tracer Wire & Appurtenances:
      a. Wire manufacturer, model & size.
      b. Splice connectors.
      c. Terminal end devise details.
   7. Individual Valve Structure Build Sheets:
      a. Top, bottom and invert elevations.
      b. Pipe orientation.
      c. Individual precast concrete section dimensions.
      d. Prefabricated rubber boot material & manufacturer.
      e. Casting manufacturer & model.

B. Post Construction:

1. Witnesses:
   a. Three witness measurements to buried fittings, valves and curb boxes from permanent fixtures such as building corners.

1.04 JOB CONDITIONS:

A. Interrupting Water Service:
   1. Scheduling: Obtain Owner's approval prior to interruption of service.
   2. Provide notice of twenty-four (24) hours to affected occupants and twenty-four (24) hours to Fire Department of time and duration.
   3. Provide stand-by service as required; outage not to exceed four (4) hours.
   4. Existing valve operation shall be by Owner's employees only.
   5. Prevent contamination of existing water mains.

B. Install service lines after pressure and bacteriological testing is accepted.

C. Clean up promptly following pipe installation within maximum of 600 feet behind pipe laying operation. Clean up includes backfill and rough grading.

D. Salvage all existing valve boxes, curb boxes and hydrants removed and deliver to the Owner’s yard. Hydrants shall be removed carefully without causing damage to the hydrant and fittings.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Cement Lining: AWWA C104 / ANSI A21.4 standard thickness for ductile iron pipe and fittings.

B. Hydrant Leads: Ductile iron pipe with mechanical joints.

C. All materials which may come in contact with water intended for use in the public water supply shall be certified to meet ANSI/NSF Standard 14, 61, 372 & 600.

D. All chemicals which may come in contact with water intended for use in the public water supply shall be certified to meet ANSI/NSF Standard 60.

2.02 PIPE:

A. PVC: AWWA C900, Pressure Class 165 (DR 25) or AWWA C909 Pressure Class 165. The pipe shall meet NSF Standard 14 for potable water and be stamped NSF-pw on the pipe wall.

B. Ductile Iron: AWWA C151 / ANSI A21.50 and ANSI A21.51; Class 52.

C. High density polyethylene (HDPE) pipe: HDPE pipe shall be made from a high density, extra high molecular weight material designated as PE3408 with an SDR of 11 or less with working pressure of at least 160 psi. ASTM D3350-83 cell class 345434C. The pipe shall meet current AWWA C906 (4-63 inches). Materials must be listed and approved for use with potable water under ANSI/NSF Standards.

D. Service Tubing:
   1. Copper: ASTM B88, Type K annealed and soft temper.

2. Polyethylene (PE): CTS-OD PE 4710 per ASTM D2737, SDR 9, 200 psi.

2.03 JOINTS:

A. Ductile Iron Pipe and Fittings:
   1. Mechanical: AWWA C111 / ANSI A21.11.
   2. Push-on: AWWA C111 / ANSI A21.11.
   3. Foster Adaptors by INFACT Corporation may be used.
      a. Epoxy Coating

B. PVC Plastic Pipe: Bell and spigot with elastomeric rubber ring gaskets ASTM D-3139.

C. HDPE
   1. Sections of polyethylene pipe shall be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment and an interfacial fusion pressure of 75 psi. The butt fusion jointing will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with graphic representation of the fusion cycle. This log shall be part of the Quality Control records.
   2. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.
   3. Mechanical joining will be used where the butt fusion method cannot be used. Mechanical jointing will be accomplished by either using a HDPE flange adapter with Ductile Iron back-up ring or HDPE Mechanical Joint adapter with Ductile Iron back-up ring.
   4. Socket fusion, hot gas fusion threading, solvents and epoxies will not be used to join HDPE pipe.

D. Service Tubing and Fittings:
   1. Copper: Flared or compression.
   2. Polyethylene (PE): Mechanical or compression with stainless steel stiffener.

2.04 TRACER WIRE:

A. If PVC or HDPE pipe is used in this project, the Contractor shall install a 10-gauge solid copper locator wire with insulation suitable for direct burial with the water main. The locator wire shall be attached to the main at approximately 15 feet intervals with plastic cable ties. Splices shall be soldered copper-to-copper and shrink-wrapped to establish insulation across spliced length. A minimum of 6 feet of wire shall be left accessible inside structures and at fire hydrants. The Contractor shall be responsible for testing continuity of wire locator.

2.05 FITTINGS:

A. Ductile Iron: AWWA C110 / ANSI A21.10, or AWWA C153 / ANSI A21.53, Class 54, 250 psi working pressure through 12 inches and 150 psi above.

B. HDPE
   1. Butt Fusion Fittings – Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing stand of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers, Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits and per AWWA C906.
   2. Electrofusion Fittings – Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits per AWWA C906.
   3. Flanged and Mechanical Joint Adapters – Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

2.06 VALVES (OPEN COUNTERCLOCKWISE)

A. Gate: AWWA C515 Resilient seated, epoxy coated surfaces, rubber encapsulated gate, bronze non-rising stem with double o-ring seal. Provide full diameter unobstructed flow. End connections shall match pipe.

B. Boxes: Three (3) section cast iron with lid marked WATER:
   1. Upper section: Screw on adjoining center section and full diameter throughout. Place geotextile fabric around threaded joint of risers, if used.
   2. Center section: Minimum 5 inch inside diameter.
   3. Base section: Fit over valve bonnet and shaped round for valves through 10 inch and oval for 12 inch and over. Place geotextile fabric around valve bonnet.

2.07 HYDRANTS (OPEN COUNTERCLOCKWISE):

A. AWWA C502, mechanical joint with drain outlet. The drain shall be unplugged to naturally well-drained soils if above the seasonal high groundwater level and plugged if below the seasonal high groundwater level, in poor draining soils, or in contaminated soils.

B. Residential: 5-inch size with 6-inch inlet connection, 2 - 2½ inch hose nozzles and 1 - 4-inch pumper nozzle.

C. Commercial: 5-inch size with 6-inch inlet connection, 2 - 4½ inch pumper nozzles.

D. Provide National Standard Fire Hose Thread.

E. Manufacturer: Owner’s standard.

F. Color: Owner’s standard. Painted at factory with primer and two (2) coats.

G. Barrel length shall be properly sized, so the centerline of the pumper nozzle is 21” to 27” above grade at the specified depth of cover over the pipe.

H. Hydrant Extension: 36-inch maximum, limited to one per hydrant.

1. Install between breakaway flange and top of hydrant lower section.

2.08 VALVE CHAMBERS:

A. Precast Units: ASTM C478
   1. Joints: Cement mortar, preformed bituminous rope or "O" ring gaskets.
   2. Pipe openings: Pipe diameter plus 6 inch maximum.

B. Concrete: 3500 psi 28-day, 4-inch maximum slump.

C. Concrete Radial units: ASTM C139.

D. Grade Rings: ASTM C478.

E. Mortar: ASTM C270, 1-part Portland cement, 1-part lime and 3 parts sand by volume.

F. Manhole Steps:
   1. Polypropylene encapsulated steel.
   2. Dimensions: 10-inches wide, 4-inch minimum clear tread depth, spaced 16 inches apart.
   3. Steps shall be in accordance with:
      a. ASTM C 478
      b. ASTM D 4101 (polypropylene)
      c. ASTM A 615 (steel)

G. Chamber Castings: East Jordan 1045Z1 A cover or Neenah R-1916-F two (2) hole cover; with letter W.

2.09 SERVICE FITTINGS:

A. Corporation Stops:
   1. For copper service tubing:
      a. Flared:
         1) Mueller Co. H-15000
         2) Ford FB-600
      b. Compression:
         1) Mueller H-15008
         2) Ford F-1000 or FB-1000
   2. For polyethylene service tubing:
      a. Mueller Co. H-15008
      b. Ford F-1000 or FB-1000.
   3. Tapping asbestos-cement pipe only: Hays Mfg. Co. Hays-Seal.

B. Curb Stops:
   1. Flared:
      a. Mueller Co. H-15204
      b. Ford B22
   2. Compression:
      a. Mueller H-15209
      b. Ford B44

C. Curb Boxes:
   1. Arch Type:
      a. Mueller Co. H-10306 (with H-10310 base for 2” curb stop)

b. Ford EA2-55-50
c. Tyler No. 6500
2. Minneapolis Type:
a. Mueller Co. H-10300
b. Ford EM2-55-56

D. Copper Alloy (Brass & Bronze) documentation for dezincification protection to be submitted in accordance with the Submittals section of this specification:
1. All parts of Corporation Stops, Curb Stops and Service Line Couplings and any other copper alloy fittings that come into contact with potable water must be constructed of an alloy with the following Copper Alloy Unified Number System (UNS) designations: C89833, C87850, C27451, C69300; or
2. The copper alloy must be annealed with documentation provided; or
3. The copper alloy must be tested for:
a. ISO 6509-1 and 6509-2; Dezincification resistance with acceptance criteria of:
1) Maximum depth dezincification of 200 microns in any one location, and
2) Average depth dezincification of 100 microns or less, and
b. Resistance to stress corrosion per the latest version of ISO 6957.

2.10 MISCELLANEOUS:

A. Service Clamps:
1. Painted ductile iron saddle with dual stainless-steel bands and hardware
a. Ford FCD202
b. Mueller DR 2 S

B. Tie Rods and Clamps: Clow Corp. or equal.

C. Polyethylene Encasement:
1. Material: ASTM D-4976 Polyethylene, cross-laminated, high density, 4 mils thick, conforming to ASTM A674 and AWWA C105.
2. Closing Tape: Minimum 2-inch-wide Poly Ken #900 or Scotchwrap #50.

D. Mechanical Joint Restraint: Megalug by EBAA Iron Sales, Inc., or approved equal.

E. Pipe Insulation: Closed cell extruded polystyrene 2-inch-thick rigid board manufactured by Dow, Owens Corning approved equal.

F. Tapping Sleeve and Valves:
1. Compliant with AWWA C223
2. 200 psi minimum working pressure.
3. Sleeve Body shall be of all stainless-steel construction with passivated welds to restore stainless steel characteristics.
4. Flanged or Mechanical Joint outlet to accept valve.
5. Sleeve shall include ¾” diameter brass test plug located in the top of the branch outlet.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Alignment and Grade:
1. Deviations: Notify Engineer and obtain instructions to proceed where there is a grade discrepancy, or an obstruction not shown on plans.

a. Verify location and depth of existing utilities in advance of construction and provide adjustments in alignment and grade of water main at no additional cost to Owner.

2. Depth of pipe: Minimum cover over pipe below finished grade by zones (unless otherwise indicated on plans):
   a. Lower part of lower peninsula of Michigan and south (South of the north boundary of tier of townships 20 north which is approximately highway US 10): 5 feet - 0 inches.
   b. Upper part of lower peninsula: 5 feet - 6 inches.
   c. Upper Peninsula: 6 feet - 0 inches.
3. High points in pipeline: Locate at services and hydrants.

B. Bedding:
1. Method: See *Methods of Bedding Pressure Pipe* detail.
   a. Utilize Method II bedding for PVC & HDPE pipe.
2. Provide bedding area backfill as specified elsewhere.
3. Provide continuous bearing supporting entire length of pipe barrel evenly. Excavate for bells of pipe joints.

C. Cleaning Pipe and Fittings:
1. General: Provide interior free of foreign material and joint surfaces free of lumps and blisters.

3.02 INSTALLATION:

A. General: Meet requirements of AWWA C600 for ductile iron pipe, AWWA C605 for PVC pipe, AWWA M55 for HDPE pipe, and these specifications.

B. Laying Pipe:
1. Prevent entrance of foreign material and plug watertight when left unattended.
2. Provide pipe length and bedding as a unit in a frost free, dry trench.
3. Provide minimum vertical separation between water main and crossing sanitary sewer, storm sewer or force main of 18 inches, measured from edge of pipe to edge of pipe. Provide minimum horizontal separation between water main and parallel sanitary sewer, storm sewer or force main of 10 feet, measured from edge of pipe to edge of pipe.
4. Approval required for pipe lengths less than 6 feet.
5. Joint deflection for ductile iron pipe shall not exceed the following values or as recommended by pipe manufacturer.

Maximum Joint Deflection

	Push-On Joint		Mechanical Joint	
Pipe Size	Deflection Angle (Deg-Min)	Maximum Offset (inches)*	Deflection Angle (Deg-Min)	Maximum Offset (inches)*
4”	3° - 30’	14”	6° - 15’	23”
6”	3° - 30’	14”	5° - 20’	20”
8”	3° - 30’	14”	4° - 00’	15”
12”	3° - 30’	14”	4° - 00’	15”
16”	2° - 15’	8¼”	2° - 40’	10”
24”	2° - 15’	8¼”	1° - 45’	7”

*Offsets are based upon 18-foot lengths of pipe

C. Cutting Pipe:
   1. PVC: Power saw or hand saw.
   2. Ductile iron: Power saw.
   3. Asbestos Cement: ASTM E 2394 – 04.

D. Jointing:
   1. Mechanical:
      a. Lubricate as recommended by manufacturer.
      b. Tighten bolts evenly to 75 to 90 foot-pounds.
   2. Push-on:
      a. Lubricate as recommended by manufacturer.
      b. Shape beveling as recommended by manufacturer.
   3. Pre-stressed Concrete Cylinder:
      a. Lubricate as recommended by manufacturer.
      b. Grouting: Fill external and internal recesses and trowel inside.
   4. Plastic: Manufacturer's standard.

E. Setting Valves, Fittings and Fire Hydrants:
   1. Valves: Set plumb.
   2. Valve boxes:
      a. Base section: Center and plumb over operating nut and 2 inches above bonnet joint.
      b. Upper section: Set cover ¼- inch below finished grade.
      c. Witnesses: Provide 3 measurements to permanent surface features.
   3. Hydrants:
      a. Positioning: Plumb with pumper nozzle facing curb and nozzle centerline 21-27 inches above finished grade.
      b. Provide necessary length of 6-inch pipe for hydrant leads.
      c. Provide access to all hydrants.
   4. Tie valves to tees and crosses and tie hydrants to valves.
   5. Provide mechanical joint restraint in accordance with the pipe restraint table in Paragraph 3.02 I.1.

F. Chambers:
   1. Base Bedding: Provide 4-inch pea stone with full and even bearing in impervious soils or wet conditions. Otherwise provide on undisturbed frost-free dry subgrade.
   2. Precast: Fill joint space completely and trowel.
   3. Provide casting setting as follows:
      a. Existing pavement: Flush:
      b. Gravel grade: 4 inches below.
      c. Unpaved areas: Finished grade.

G. Connections:
   1. Existing water mains:
      a. Provide temporary support during cut-in.
      b. Disinfect by swabbing pipe, valves and fittings with four percent (4%) chlorine solution.
      c. Pressure off: Install mechanical joint solid sleeve.
      d. Pressure on: Install tapping sleeve, valve and box.
      e. Asbestos cement pipe: Meet requirements of ASTM E 2394 – 04.
   2. Tapping sleeve and valves:

a. Install in accordance with manufacturer's installation instructions.
b. Contractor shall verify material and outside diameter of the pipe to be tapped prior to purchasing tapping sleeve.
c. Disinfect sleeve and valve prior to installation by swabbing a 1% chlorine solution in accordance with other parts of this section.
d. After sleeve body and valve is installed and before the tap is made, the Contractor shall pressure test the sleeve by pressurizing through the test plug. The test must be conducted with the valve open using a mechanical joint plug or cap. Fill void with water expelling all air and pressurize to 150psi. No visible leaks may be observed.
e. Tap cutout diameter: The diameter of the tap cutout shall be maximized to preserve hydraulic efficiency of the connection. In no case shall the diameter of the cutout be less than 80% of the branch diameter.

3. Service lines:
   a. Align at right angles to street or easement line.
   b. Minimum depth shall be same as pipe.
   c. Install after acceptable pressure test and chlorination of water main.
   d. Tap must be installed on the main when under full pressure.
   e. Curb boxes: Set plumb and provide 3 measurements to surface features.
      1) Locate at easement line within easement or at right-of-way line within road right-of-way, unless otherwise directed.
      2) Temporarily cover curb box with 5' long section of 4" PVC pipe to mark location during construction.
      3) Set cover ¼-inch below finished grade.
   f. Tapping shall be at 45º above center and shall provide horizontal loop at corporation stop.
   g. Plastic Pipe: Tap pipe using a hole saw cutter (new cutter) and double strap saddle per manufacturer's recommendation. No direct tapping allowed.

Maximum tap sizes shall be as follows:

	Pipe Size									
Type of Pipe	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"
Ductile Iron: Max Direct Tap Size	½"	¾"	1"	1¼"	1½"	2"	2"	2"	2"	2"
All Pipe: Max Tap Size w/ Double Strap	1"	1½"	2"	2"	2"	2"	2"	2"	2"	2"

H. Dead-end water main stubs longer than 20 feet:
   1. Install standpipe with shutoff at dead ends to aid in chlorinating, testing and flushing. Remove standpipe upon approval of water main.

I. Pipe Joint Restraint:
   1. Provide mechanical joint restraint for the minimum lengths shown in the table below:

PIPE RESTRAINT LENGTH REQUIRED (FEET)*							
Pipe Dia.	Tees 90° Bends	45° Bends	22½° Bends	11¼° Bends	Dead Ends	Reducers (one size)	**
4"	23'	9'	5'	2'	57'		
6"	32'	13'	6'	3'	82'	43'	63'
8"	41'	17'	8'	4'	104'	43'	55'
12"	58'	24'	12'	6'	149'	80'	120'
16"	74'	31'	15'	7'	192'	82'	110'

20”	89’	37’	18’	9’	233’	82’	104’
24”	104’	43’	21’	10’	272’	82’	99’
30”	123’	51’	25’	12’	328’	115’	148’
36”	141’	58’	28’	14’	379’	115’	140’

* The length of restrained pipe required shown in the table above is based on trench backfill being compacted to 95% of the maximum density according to the Modified Proctor Method. The above table does not consider polyethylene wrapped pipe. If the pipe is wrapped with polyethylene, a greater length of restrained pipe will be required. Unless otherwise specified, a multiplier of 1.5 shall be used to determine the required length when the pipe is wrapped with polyethylene.

** If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary.

a. Tees: Pipe restraint length shown in the table above shall be provided in the branch direction. Also, the minimum length of pipe restraint in the straight through (run) direction shall be 10 feet on both sides of the tee.
b. Bends: Pipe restraint length shown in the table above shall be provided on both sides of the bend.
c. Dead End: Pipe restraint length shown in the table above shall be provided back from the dead-end plug.
d. All joints shall be restrained for pipe within casings.
e. All joints between bends on water main offsets shall be restrained.

J. Reaction Backing (allowed only where restrained joints cannot be used and when approved by Owner):
1. Placement:
a. Place concrete manhole block next to pipe and concrete reaction backing behind. Mega lugs and fitting bolts shall not be covered with concrete.
2. Bearing area: Provide the following square feet of concrete against trench wall in sand:

Pipe Size	Tees Plugs (Sft)	Hydrants 90º Els (Sft)	Wyes 45º Els (Sft)	22½º Els (Sft)	11¼º Els (Sft)
4"	2	1	1	1	1
6"	3	3	2	1	1
8"	4	6	3	2	1
10"	7	9	5	3	2
12"	9	11	6	3	2
14"	11	15	8	5	3
16"	13	20	10	6	3
18"	16	25	12	7	4
20"	20	28	14	8	4
24"	28	40	20	11	6

3. Other Soil Conditions:
a. Cement sand or hardpan: Multiply above by 0.5
b. Gravel: Multiply above by 0.7
c. Hard dry clay: Multiply above by 0.7
d. Soft clay: Multiply above by 2.0

e. Muck - secure all fittings with Megalug retainer glands or tie rod clamps and concrete reaction backing the same as listed for sand conditions.

K. Repair sewer laterals disturbed during construction with PVC schedule 40 pipe and FERNCO fittings.

L. Pipe Insulation: Where noted on Drawings, place insulation board 4 feet wide over pipe at top of bedding.

3.03 SANITARY AND STORM SEWER CROSSINGS:

A. Applies to gravity flow sanitary sewer, forcemain, and gravity flow storm sewers.

B. Minimum vertical distance measured from the outside of the water main pipe to the outside of the sewer pipe is 18”.

C. One full length of water main pipe shall be located so both joints are as far from the sewer as possible. This may require cutting the adjacent water main pipe to length, so the watermain crossing pipe is a full pipe length.

3.04 FIELD QUALITY CONTROL:

A. Testing and Inspection:
1. General:
a. Observation: By Owner or Owner’s representative.
b. Completion: Before connecting to existing line.
c. Notification: Pretest and arrange for observation of test. Contractor to pay additional cost to witness retests.
d. Equipment and assistance: Provide.
e. Required water: By Owner where available from municipal system.
f. Connection to existing water main: After passing pressure and leakage tests, and bacteriological testing.
g. Meet requirements of AWWA C600 for ductile iron pipe, AWWA C605 for PVC pipe, AWWA M55 for HDPE pipe, and these specifications.
2. Electrical continuity: Test ductile iron pipe for continuity and repair breaks.
3. Pressure/Leakage Test:
a. Conditions: Air or air-water methods of applying pressure prohibited.
b. Sequence: Prior to Flushing and Chlorination.
c. Procedure: Fill system slowly, expel air through corporation stop at high points and apply pressure.
d. Pressure: Maintain 150 psi.
e. Duration: Two (2) hours.
f. Make-up water: From measurable source.
g. Leakage: Quantity of water supplied to maintain test pressure.
h. Allowable: Less than:

$$L = \frac{SD \times \text{square root of } P}{148{,}000}$$

where,
L = leakage (gallons per hour).
S = length of pipe (feet).
D = nominal pipe diameter (inches).
P = average test pressure (pounds per square inch gauge).

i. Correction: Repair defects and repeat test until acceptable.

j. Maximum length of pipe to be tested shall be 2000 feet.

4. Testing valves only: Maintain pressure on main and check all valves as follows:
   a. Vent extreme ends of main and briefly check each valve progressively back towards test point.
   b. Allowable pressure drop shall be less than 10 psi in five (5) minutes with test pump off.
   c. Correction: Repair defects and repeat test until acceptable.

3.05 FLUSHING:

A. Flushing: Shall be performed in accordance with ANSI/AWWA C600, C605 & C651.
   1. Sequence: Following pressure testing and prior to chlorination.
   2. Maximum intervals: 2,000 feet.
   3. Required water: By Owner where and when available from municipal system. Maintain minimum of 40 psi residual pressure in existing water system.
   4. Minimum velocity: 3.0 feet per second at pipe wall. See table below for size and number of taps or hydrant openings required to achieve minimum velocity:

Required Flow & Openings (either taps or hydrants) to Flush Pipelines at 3.0 ft/sec						
Pipe Dia.	Flow required to produce ~3.0 ft/sec velocity in main (gpm)	Size of Tap Used Number of Taps Required on Pipe			Number of Hydrant Outlets	
		1”	1½”	2”	2½”	4”
4”	120	1	1		1	1
6”	260		2		1	1
8”	470		3	2	1	1
10”	730			3	1	1
12”	1,060			5	2	1
16”	1,880				2	1

B. The Contractor shall submit a procedure schedule outlining the method the Contractor proposes to use for flushing water mains. Utility owner shall be given notice by Contractor prior to any flushing.

C. Flushing may be performed prior to pressure testing or following pressure testing, but in any case, prior to chlorination of the water main.

3.06 DISINFECTION:

A. Shall be performed in accordance with ANSI/AWWA C651 as modified by the Michigan Administrative Rules and herein.
   1. Continuous-Feed Method only.
      a. Conducted by Contractor.
      b. Observed by Owner or Owner’s representative.
   2. Chlorine gas shall not be used nor is it allowed on-site.
   3. Potable water for disinfection provided by Owner where available from a municipal system. Contractor shall provide a suitable a cross-connection control device.
   4. Sequence:
      a. Preliminary Flushing:
         1) Fill pipe and remove all air pockets.

2) Flush pipe at 3 feet per second (fps) for 3 pipe volumes.
   i. 6” pipe: 260 gpm is 3 fps.
   ii. 8” pipe: 470 gpm is 3 fps.
   iii. 10” pipe: 730 gpm is 3 fps.
   iv. 12” pipe: 1,880 gpm is 3 fps.
3) The above flushing requirements may be modified to fit site conditions at the discretion of the Owner’s or Owner’s representative.

b. Chlorination:
1) Flow potable water and concentrated chlorine solution into the main at a constant rate to produce a chlorinated water solution of 25 mg/L chlorine throughout the length of the main.
2) The chlorinated water solution shall be retained in the pipeline for 24-hours minimum during which time the valves and hydrants shall be operated to disinfect their parts.
3) At the end of the 24-hour period, the chlorinated water solution shall have a chlorine concentration of not less than 10 mg/L.

c. Final Flushing:
1) After the required 24-hour retention period, the heavily chlorinated water shall be flushed from the main and each branch.
2) Flushing shall continue until the water in the main has a chlorine concentration no higher than the prevailing water system and acceptable for domestic use.
3) Dechlorination of flushed water:
   i. If there is any possibility the heavily chlorinated water will cause damage to the environment, a neutralizing chemical shall be applied to the water to thoroughly neutralize the residual chlorine in accordance with AWWA C655.
   ii. Additionally, the Contractor must follow State & local standards.

d. Bacteriological Testing:
1) After final flushing, samples shall be taken by Owner with assistance from the Contractor.
   i. All laboratory fees shall be paid for by the Contractor.
   ii. Owners time for resampling due to failed testing shall be paid for by the Contractor.
2) Testing laboratory shall be certified for drinking water testing in the state of the project.
3) Two sets of samples taken, the first taken after final flushing and the second not less than 24-hours after the first. Both sets of samples must pass.
4) Each set of samples includes one sample from every 1,200’ of main including one at each end of the pipeline and one at the end of each branch greater than 20’ long.

B. Disinfection report; record:
1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Initial and 24-hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
5. Date and time of flushing start and completion.
6. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological report record:
1. Date issued, project name, and testing lab name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.

4. Test locations.
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards.
8. Bacteriologist's signature and authority.

D. Final Connections to Existing Mains:
   1. Each connection must be less than 20’ long or additional disinfection procedures will be required.
   2. All interior surfaces of pipes, fittings, valves, etc…that may come into contact with potable water shall be swabbed or sprayed with a minimum 1% chlorine solution just before assembly.

END OF SECTION

SECTION 33 31 00 - SANITARY SEWERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes work required for sanitary sewers, structures and appurtenant work.

1.02 REFERENCES:

A. ASTM – American Society of Testing Materials, latest edition.

B. NCPI - National Clay Pipe Institute.

1.03 SUBMITTALS:

A. Pre-Construction:
   1. Individual Manhole Build Sheets:
      a. Top, bottom and invert elevations.
      b. Pipe orientation.
      c. Individual precast concrete section dimensions.
      d. Prefabricated rubber boot material & manufacturer.
   2. Castings:
      a. Manufacturer & model numbers.
   3. Pipe & Fittings:
      a. Manufacturer, material & ASTM designation.
      b. Joint construction details.

B. Post Construction:
   1. Witnesses:
      a. Three witness measurements to end of laterals from permanent fixtures such as building corners.
      b. Measurement from lateral wyes to nearest downstream manhole.
      c. Invert elevation at end of each lateral.

1.04 JOB CONDITIONS:

A. Maintain existing sanitary sewer system operational. At new connections to the existing sewer system, plug the downstream end of the new sewer until the new sewer has been tested and accepted.

B. Do not bypass wastewater to ground or surface waters.

C. Install service lines as pipe laying progresses and within maximum of 600 feet of mainline sewer installation.

D. Clean up promptly following pipe installation and within maximum of 400 feet behind pipe laying operation. Clean-up includes backfill and rough grading.

PART 2 - PRODUCTS

2.01 PIPE:

A. Classification Table:

Type and Size	Design Depth (feet) 0' - 10'	10' - 19'	Over 19'
Plastic (PVC) 8" - 15"	ASTM D3034-SDR35	ASTM D3034-SDR35	ASTM D3034-SDR26 (with SDR35 O.D.)
Plastic (PVC) 18" & larger	ASTM F679 Solid Wall	ASTM F679 Solid Wall	ASTM F679 Solid Wall
Plastic (PVC) 4" - 6"	ASTM D3034-SDR35	ASTM D3034-SDR35	ASTM D3034-SDR26 (with SDR35 O.D.)
Plastic (ABS) 4" - 6"	ASTM D1527 Schedule 80	ASTM D1527 Schedule 80	ASTM D1527 Schedule 80
Plastic (PE) 4" - 6"	ASTM D2239-SDR15 Series 60	ASTM D2239-SDR11.5 Series 80	ASTM D2249-SDR9 Series 100

B. Concrete Pipe: Provide circular reinforcing, wall B.

C. Service Pipe and Fittings: Provide minimum 6-inch, same classification as mainline pipe.
   1. Plastic (PVC) ASTM D3034 – SDR 35 or 26, or plastic truss (ABS) ASTM D2680.

D. Plastic Pipe: Provide seating marks where couplings are used for jointing.
   1. joints: Provide rubber "O" ring.

E. Joint Repair or Connecting to Existing Sewer Pipe of Different Material:
   1. Provide Fernco adapter coupling and stainless-steel bands.

F. Provide Joint Materials as Indicated for the following Pipes:
   1. Clay: ASTM C425.
   2. Concrete: ASTM C443.
   3. Plastic truss (ABS): ASTM D2680.
   4. Plastic (ABS): ASTM D1527.
   5. Plastic (PE): ASTM D2239.
   6. Plastic (PVC): ASTM D3212 or ASTM F679 (18" & larger).

2.02 MANHOLES

A. Manholes shall be precast units.

B. Precast Units: ASTM C478 with circular reinforcement, modified for "O" ring gaskets.

1. Pipe Openings: Provide flexible, watertight rubber boot using mechanically compressed flexible joint re-seal, link-seal, Pressure Wedge, Kor-N-Seal or equal. Conform to ASTM C923.

C. Concrete: 3500 psi 28-day, 4-inch maximum slump.

D. Concrete Brick: ASTM C55, Grade N-1.

E. Grade Rings: ASTM C478 with "O" ring gaskets or ASTM D4976 HDPE adjusting rings with butyl sealant manufactured by Ladtech, Inc. or equal.

F. Mortar: ASTM C270: 1-part Portland cement, 1-part lime and 3 parts sand by volume.

G. Manhole Steps:
   1. Polypropylene encapsulated steel.
   2. Dimensions: 10-inches wide, 4-inch minimum clear tread depth, spaced 16 inches apart.
   3. Steps shall be in accordance with:
      a. ASTM C 478
      b. ASTM D 4101 (polypropylene)
      c. ASTM A 615 (steel)

H. Sanitary manhole casting: East Jordan 1045Z1 A cover or Neenah R-1642, solid lid; with letter S.

I. Watertight Manhole Castings (bolted and gasketed): East Jordan 1045ZPT 1040APT 4-bolt Sanitary Sewer Assembly or Neenah R-1916 F with watertight assembly; with letter S.

J. Cement Waterproofing: Masonry filler.

K. Pipe Insulation: Closed cell extruded polystyrene 2-inch-thick rigid board manufactured by Dow, Owens Corning or approved equal.

L. Drop pipe diameter:
   1. 8" diameter for incoming pipe sizes 8" through 12".
   2. 10" diameter for incoming pipe sizes 15" through 18".
   3. 12" diameter for incoming pipe sizes 21" through 27".
   4. 15" diameter for incoming pipe sizes 30" through 36".

PART 3 - EXECUTION

3.01 PREPARATION:

A. Alignment and Grade:
   1. Deviations: Notify Engineer and obtain instructions to proceed where there is a grade discrepancy, or an obstruction not shown on the plans.
   2. Laser Beam Control: Provide.

3. Check grade: At set-up point, 25-foot, 50-foot, 100 foot and 200-foot points thereafter to the next set-up point.
4. Projector advancement: Reset at each manhole.

B. Bedding:
1. Method: See *Methods of Bedding Gravity Pipe* detail.
2. Provide bedding area backfill as specified elsewhere.
3. Provide continuous bearing by supporting entire length of pipe barrel evenly. Excavate for bells of pipe joints.

3.02 INSTALLATION:

A. Laying pipe:
1. Direction shall be upstream with spigot or tongue end downstream and bell end upstream.
2. Joints shall be smooth and clean.
3. Place pipe length and bedding as a unit in a frost free, dry trench.
4. Install PVC pipe in accordance with ASTM 2321 and these specifications.
5. Install reinforced concrete pipe in accordance with ASTM D 1479 except as exceeded by these specifications.

B. Jointing:
1. Provide solvents, adhesives and lubricants as furnished by Manufacturer.
2. Gasket position: Confirm that the gasket is in place and that the joint is properly made.

C. Manholes:
1. Fill joint space completely and trowel between sections of precast units.
2. Provide casting grade setting as follows:
a. Existing pavement: Finished grade.
b. Gravel or lawn grade: 4 inches below.
c. Unpaved areas: Finished grade.
3. Flow channels:
a. Construct with concrete up to the top of pipe and slope benches toward center of manhole. Trowel smooth.
b. Provide clean, smooth, straight flow channels for main line and laterals.
c. Provide smooth curvilinear flow channels for turning flows.
4. Casting adjustment: Concrete ring between leveling and top course of bituminous. Match cross slope of top of casting to cross slope of pavement.
5. All sanitary sewer laterals, sewer main, service connections and drop manhole pipes shall have flow channels and shall not discharge onto the surface of the bench. Outside drop connection are required for drop of 2 feet or more.

D. Abandoning and filling existing sanitary sewer and manholes:
1. Pipe: Plug ends of pipe to be abandoned and fill completely with flowable fill.
2. Manhole: Remove top 3 feet of manhole, plug pipe openings and fill manhole to be abandoned with flowable fill.

E. Connections:
1. Expose existing sanitary sewer and structures to which the new work is to be connected to confirm condition, location and elevation.
2. Connect to existing sanitary manhole by coring an opening adequate to connect the proposed pipe with a flexible rubber boot to form a watertight connection.
a. Relay and repoint loose blocks and bricks on existing block and brick structures. Rechannel flowlines and benches with concrete, trowel smooth.

3. Future Sanitary Sewer: Provide the following:
   a. Plug: Pipe 4 inch through 21 inches with standard disc.
   b. Bulkhead: Pipe 24 inch and larger with brick and mortar and ½ inch plaster coat outside.
      1) 24 inch - 36 inch: 4 inches thick.
      2) 42 inch - 60 inch: 8 inches thick.

F. Service Lines:
   1. Align at right angles to street or easement line.
   2. Grade: Provide at uniform rate from mainline wye or riser to the property or easement line, at minimum grade 1/4 inch per foot.
   3. Provide minimum depth at street right-of-way line, property line or easement line as follows (based on house with 8-foot ceiling height in basement, length on private property of 100 feet, and minimum grade on private property of 1/8 inch per foot):
      a. House with basement: 12 feet below first floor elevation or 3 feet below basement elevation, whichever is deeper.
      b. Commercial and industrial buildings, schools, churches: Confirm required depth with facility owner.
      c. The above depths govern, except that the minimum depth at the right-of-way line or property line shall be 6 feet below street or easement centerline grade.
      d. Property line riser excluded from the above minimum depths.
      e. The minimum depths shown above shall be increased based on actual basement ceiling height and distance away.
   4. Connection fitting:
      a. Locate in field.
      b. 45º or 60º Wyes: Provide on all pipe except concrete pipe.
      c. Tees: Allowed only on reinforced concrete pipe.
   5. Main riser will be allowed where cover exceeds 13 feet at mainline.
   6. Plugging: Provide standard plugs or caps securely blocked.
   7. Markers: Place a wood marker (2" x 2" minimum) at end of lateral with sufficient length to extend from invert of lateral to ground surface. Attach a steel rerod 36 inches in length immediately next to the wood marker with the top of the rerod 2 inches below grade. Cover wood marker and steel rerod with 6’ long 4” PVC pipe buried 3 feet.
   8. Witnesses: Report the following:
      a. Wyes or Tees: Measurements to nearest downstream manhole.
      b. End of Laterals: Three (3) measurements to permanent surface features and elevation.
   9. Property line Riser: Required on all laterals.

G. Bypass Pumping: Provide temporary bypass pumping of wastewater flow as required during construction or replacement of sanitary sewer.

H. Pipe Insulation: Where noted on Drawings, place insulation board 4 feet wide over pipe at top of bedding.

3.03 WATER MAIN CROSSINGS:

A. Minimum vertical distance measured from the outside of the water main pipe to the outside of the sewer pipe is 18”.

B. One full length of sewer pipe shall be located so both joints are as far from the water main as possible. This may require cutting the adjacent sewer pipe to length, so the sewer crossing pipe is a full pipe length.

3.04 TESTING AND INSPECTION:

A. General:
1. Observation: By Owner or Owner's representative.
2. Testing: Perform upon completion and before connecting to active system.
3. Leakage tests: Provide promptly following installation of sewer pipe including services and keep within maximum 1200 feet behind pipe laying operation.
4. Notification: Clean, pretest and arrange with Owner or Owner's representative for final inspection and test.
5. Provide necessary equipment, manpower and assistance.
6. Video televising: Provide prior to paving.

B. Line and Grade: Allowable drift between structures from proposed alignment will be as follows:
1. Line:
a. Through 36 inches: 0.20 foot.
b. Over 36 inches: 0.40 foot.
2. Grade:
a. Through 36 inches: 0.02 foot.
b. Over 36 inches: 0.05 foot.
c. Allowable sag between pipe joints: 5% of pipe diameter with maximum of 1-inch.
3. Repair sags in excess of tolerance prior to acceptance (required only if video televising indicates a problem).

C. Plastic pipe deformation:
1. Pipe deformation will be limited to five percent (5%) of diameter.
2. Pull GO, NO-GO type gauge through pipe by hand.
3. Contractor shall provide proof ring for GO, NO-GO gauge from the manufacturer.
4. Schedule: Conduct after final backfill has been in place a minimum of thirty (30) days, and after shutdown of dewatering operation.
5. Correction: Repair defects and retest until acceptable.

D. Video Televising:
1. Contractor shall complete video televising of new sewers prior to acceptance
2. The sewers and manholes to be televised shall be cleaned completely free of debris prior to televising.
3. Contractor shall provide to Owner or Owner's representative.

E. Leakage Testing:
1. Contractor to perform exfiltration (water or air) test unless ground water is present, in which case Contractor may opt to perform infiltration test.
2. Acceptable leakage will be as follows:
a. Water: Less than 100 gallons per inch of pipe diameter per mile of pipe per twenty-four (24) hours.
b. Air: Holding time not less than that listed in table.
3. Correction: Repair defects and repeat test until acceptable.
a. Method of repairing defects shall be approved by Owner or Owner's representative.

F. Infiltration Test (water):
1. Conditions: Minimum groundwater depth 2 feet above high point of system under test.
2. Procedure:
a. Install and maintain "V" notch weir at low end of system under test.
b. Leakage: Quantity of water measured by "V" notch weir.

G. Exfiltration Test (water):
   1. Conditions: Determine groundwater elevation.
   2. Procedure:
      a. Fill system minimum 2 feet above high point of system or 2 feet above groundwater, whichever is higher.
      b. Leakage: Quantity of water required to maintain constant level.

H. Exfiltration (air): Perform in accordance with NCPI Publication, “Low Pressure Air Test for Sanitary sewers”, and in accordance with ASTM F 1417, “Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air”.
   1. Condition: Determine groundwater elevation.
   2. Procedure:
      a. All pressure readings are above the average groundwater head.

3.05 ADJUST AND CLEAN:

A. General:
   1. Keep pipe and structures clean as work progresses.

3.06 SCHEDULES:

A. Exfiltration Air Test Table.

B. Manhole Final Inspection Punch List.

END OF SECTION

EXFILTRATION AIR TEST

Time Required for Loss of Pressure from 3.5 PSIG to 3.0 PSIG for Size and Length of Pipe indicated for Q = 0.0015 (Cu. Ft./Min./Sq.Ft. of Internal Surface Area)

Pipe Diameter (in.)	Minimum Time min; sec.	Length for Min. Time (ft.)	Time for Longer length (sec.)	Specification Time for Length (L) Shown (min:sec)										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:54
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12	3:34	3:55	4:16
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42	6:20	6:58	7:36
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54	9:54	10:53	11:52
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:48	11:24	12:50	14:15	15:40	17:06
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02	22:16	24:29	26:43
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51	32:03	35:16	38:28
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16	43:37	47:59	52:21
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17	56:59	62:41	68:23
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54	72:07	79:20	86:33
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07	89:02	97:56	106:51
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57	107:44	118:31	129:17
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23	128:13	141:02	153:51
39	18:25	61	18.054L	30:57	45:09	60:11	75:14	90:16	105:19	120:22	135:24	160:32	165:31	180:34
42	19:50	57	20.939L	34:54	52:21	69:48	87:15	104:42	122:09	139:37	157:03	174:31	191:58	209:25

Note: When 2 sizes of pipe are involved, the time shall be computed by the ratio of lengths involved.

Example: 400 feet of 10-inch pipe and 200 feet of 6-inch pipe

$$\text{Time} = \frac{\text{Length(1)} \times \text{Time(1)} + \text{Length(2)} \times \text{Time(2)}}{\text{Length(1)} + \text{Length(2)}} = \frac{400 \times 7{:}54 + 200 \times 2{:}50}{400 + 200} = \frac{400 \times 474 + 200 \times 170}{400 + 200} = 373 \text{ seconds} = \textbf{6:13 (min:sec)}$$

MANHOLE FINAL INSPECTION PUNCH LIST

- ☐ Verify specification for correct casting
- ☐ Record depth of all inverts to top of casting.
- ☐ Verify chimney adjustment rings are completely cemented in place and plaster coated.
- ☐ Verify casting is centered in the opening and completely cemented in place with no voids between casting and top of chimney. (check maximum dimensions – see Manhole Detail)
- ☐ Cement lift holes and all penetrations.
- ☐ Verify pipe penetrations are properly sealed.
- ☐ Flow lines are completed and smooth with no high or low spots.
- ☐ Flow line is poured up to spring line or ½ the diameter of pipe.
- ☐ Benches sloped to flow line at 1” per foot minimum.
- ☐ All voids in walls and bottom are cemented.
- ☐ Manhole steps and bottom are clean of concrete, bituminous, dirt, debris, etc.
- ☐ Verify slope is correct from proposed upstream to down stream inverts.
- ☐ Drainage structure constructed of blocks or bricks is plaster coated inside and outside of entire structure.
- ☐ Verify catch basin sumps are clean.
- ☐ Casting has been properly adjusted prior to final top course. (check tilt to match pavement cross slope)
- ☐ Final inspection completed before final top course of asphalt is laid.

RECOMMENDED SAFETY CHECK LIST (may not be all-inclusive)

1. Use vehicle to protect yourself from traffic.
2. Use construction cones on street with traffic (4 minimum)
3. Always wear reflectorized safety vest.
4. Follow Confined Space Entry Procedures if entering a manhole.

SECTION 33 41 00 - STORM SEWERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes work required for storm sewers, culverts, structures, under drains, drain excavation/cleanout and related work.

1.02 REFERENCES:

A. MDOT - Michigan Department of Transportation, *"2020 Standard Specifications for* Construction".

B. ASTM - American Society of Testing Materials, latest edition.

1.03 SUBMITTALS:

A. Pre-Construction:
   1. Individual Drainage Structure Build Sheets:
      a. Top, bottom and invert elevations.
      b. Pipe orientation.
      c. Individual precast concrete section dimensions.
      d. Prefabricated rubber boot material & manufacturer.
   2. Castings:
      a. Manufacturer & model numbers.
   3. Pipe & Fittings:
      a. Manufacturer, material & ASTM designation.
      b. Joint construction details.
   4. Geotextile Fabric:
      a. Manufacturer, material & ASTM designation.

B. Post Construction:
   1. Witnesses:
      a. Three witness measurements to blind taps and lateral ends from permanent fixtures such as building corners.
      b. Invert elevation at end of each lateral.

1.04 JOB CONDITIONS:

A. Maintain existing storm sewer operational.

B. Install service lines, catch basins and inlet leads as pipe laying progresses and within maximum of 600 feet of mainline sewer installation.

C. Clean up promptly following pipe installation and within maximum of 400 feet behind pipe laying operation. Clean-up includes backfill and rough grade.

PART 2 - PRODUCTS

2.01 PIPE:

A. Polyethylene (PE): MDOT 909.06.
   a. Manufacturers: ADS N-12 or Hi-Q.

B. Footing Drains: PVC pipe, ASTM D3034 SDR35, or match existing pipe material.

C. Under drains: MDOT 909.07 with geotextile sock.

2.02 PREMIUM JOINTS:

A. Concrete: ASTM C443, modified to include "O" rings on grooved pipe ends.

B. Plastic: Rubber O-Rings.

2.03 MANHOLES, CATCH BASINS AND INLETS:

A. Precast Units: ASTM C478.
   1. Joints: Cement mortar, preformed bituminous rope or "O" ring gaskets.
   2. Pipe openings: Pipe diameter plus 6 inches, maximum.

B. Concrete Radial Units: ASTM C139.

C. Grade Rings: ASTM C478 with “O” ring gaskets or ASTM D4976 HDPE adjusting rings with butyl sealant manufactured by Ladtech, Inc. or equal.

D. Manhole Steps:
   1. Polypropylene encapsulated steel.
   2. Dimensions: 10-inches wide, 4-inch minimum clear tread depth, spaced 16 inches apart.
   3. Steps shall be in accordance with:
      a. ASTM C 478
      b. ASTM D 4101 (polypropylene)
      c. ASTM A 615 (steel)

E. Manhole Castings: East Jordan 1045Z1, B cover or Neenah R-1733, vented lid.

F. Catch Basin and Inlet Castings: MDOT C, E OR K as follows:
   1. Concrete rolled curb and gutter: Cover C.
   2. Bituminous valley gutter: Cover C.
   3. Ditch centerline: Cover E.
   4. Concrete standard curb and gutter: Cover K. Cover KK where called for on plans. Cover KK shall be East Jordan Iron Works #7030 T1 or T3, Neenah Grate r-3246 or equal.
   5. Concrete gutter pan within influence of ADA sidewalk ramp: EJIW 5100 with 5105 M3 ADA grate, or approved equal.
   6. Catch basin backs / grates shall be marked with lettering “DUMP NO WASTE, DRAINS TO WATERWAYS”.

2.04 RIPRAP:

A. Riprap: MDOT 916.01.C.

B. Geotextile Fabric: MDOT 910.03.B and Table 910-1.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Alignment and Grade:
1. Deviations: Notify Engineer and obtain instructions to proceed where there is a grade discrepancy, or an obstruction not shown on the drawings.
2. Expose existing utilities at crossings of proposed storm sewer in advance of laying pipe to verify existing depth. Advise Engineer of conflicts in grade and provide adjustments in grade of storm sewer at no additional cost.

B. Laser Beam Control:
1. Check grade at set-up point, 25-foot, 50-foot, 100 foot and 200-foot points thereafter to the next set-up point.
2. Projector advancement: Reset at each manhole.

C. Bedding:
1. See *Methods of Bedding Gravity Pipe* detail.
2. Provide bedding area backfill as specified elsewhere.
3. Provide continuous bearing by supporting entire length of pipe barrel evenly. Excavate for bells of pipe joints.

3.02 INSTALLATION:

A. Laying pipe:
1. Direction shall be upstream with spigot or tongue end downstream and bell end upstream.
2. Joints shall be smooth and clean.
3. Place pipe length and bedding as a unit in a frost free, dry trench.
4. Install reinforced concrete pipe in accordance with ASTM D 1479 except as exceeded by these specifications.
5. Footing drains and under drains shall have 4'-0" minimum cover.

B. Jointing:

1. Premium:
a. Solvents, adhesives and lubricants shall be furnished by Manufacturer.
b. Seating: Fully.
c. Gasket position: Check.

C. Manhole, Catch Basins and Inlets:
1. Base bedding: Provide 4-inch pea stone with full and even bearing in impervious or wet conditions. Otherwise provide on undisturbed frost-free dry subgrade.
2. Precast: Fill joint space completely and trowel.
3. Block: Set in full bed of mortar with key slots filled, joints maximum ½ inch at inside face and wipe joints. Plaster coat complete interior of structure with ½ inch coat of cement mortar.
4. Provide manhole casting grade setting as follows:
a. Existing pavement: Finish grade.
b. Gravel or lawn grade: 4 inches below.
c. Unpaved areas: Finished grade.
5. Provide catch basin casting grade setting as follows:
a. Gutter grade: ½ inch below.

b. Unpaved areas: 6 inches below finished grade.

6. Manhole casting adjustment: Concrete ring between leveling and top course of bituminous. Match cross slope of top of casting to cross slope of pavement.
   a. HDPE adjusting rings:
      1) Install per manufacturer's recommendations.
      2) Seal to manhole structure, casting and to one another by means of an approved butyl sealant.
      3) Adjustment for matching road grade and/or cross slope shall be made utilizing a molded and indexed slope ring.
7. Flow Channels:
   a. Not Required.

D. Riprap: MDOT 813.03.E.

E. Connections:
1. Expose existing storm sewer and structures to which the work is to be connected to confirm condition, location and elevation.
2. Connect to existing storm manhole by coring or jack hammering opening adequate to insert pipe and secure circumference of pipe with non-shrink cement mortar.
   a. Relay and repoint loose blocks and bricks on existing block and brick structures.
   b. Rechannel flowlines and benches with concrete, trowel smooth.
3. Future Storm Sewer:
   a. Plug: Pipe 4 inch through 21 inches with standard disc.
   b. Bulkhead: Pipe 24 inch and larger with brick and mortar, ½ inch plaster outside.
      1) 24 inch - 36 inch: 4 inches thick.
      2) 42 inch - 60 inch: 8 inches thick.
      3) 60 inch and larger: 12 inches thick.

F. Under drains: MDOT Section 404.
1. Connect to downstream storm manholes.

G. Footing Drains:
1. Connect to edge drain (under drain) or directly to catch basin. Connections to the mainline storm sewer will not be allowed.

H. Drain Excavation/Cleanout:
1. Section: 4-foot flat bottom with 1 on 2 maximum side slopes.
2. Remove trees and brush as required, unless otherwise indicated.
3. Excess excavated material:
   a. Drain excavation of 2 feet or less: Spread, level and grade to drain along top of banks.
   b. Drain excavation in excess of 2 feet: Remove from site and place in an upland disposal site.

3.03 TESTING AND INSPECTION:

A. General:
1. Observation: By Owner or Owner's representative.
2. Completion: Before connecting to active system.
3. Notification: Clean and arrange for inspection.

B. Line and Grade: Allowable drift between structures from proposed alignment will be as follows:
1. Line:

a. Through 36 inches: 0.40 foot.
b. Over 36 inches: 0.80 foot.

2. Grade:
a. Through 36 inches: 0.05 foot.
b. Over 36 inches: 0.10 foot.

3.04 ADJUST AND CLEAN:

A. General:
1. Keep pipe and structures clean as work progresses.

END OF SECTION