



PROJECT MANUAL

TURTLE MOUNTAIN COMMUNICATIONS NEW BUILDING

ARCHITECT'S PROJECT NUMBER 24-054

PROJECT ADDRESS

1109 11TH STREET EAST

BOTTINEAU ND, 58318

ISSUE DATE: 01/15/2025

ISSUED BY:

ICON ARCHITECTURAL GROUP

222 EAST MAIN STREET SUITE B

ICONARCHITECTS.COM | 701.751.0430



END OF SECTION

**SECTION 000103
PROJECT DIRECTORY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Identification of project team members and their contact information.

1.02 OWNER:

- A. Turtle Mountain Communications
1. 411 7th Avenue.
 2. Langdon, ND 58249.
- B. Primary Contact: All correspondence from the Contractor to the Architect will be through this party, unless alternate arrangements are mutually agreed upon at a preconstruction meeting.
1. Steve Swanson - General Manager and CEO
 2. (701) 256 5156
 3. steves@corp.utma.com

1.03 ARCHITECT:

- A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
1. ICON Architectural Group
 - a. 222 East Main Street Suite B
 - b. Mandan, ND 58554
 - c. (701) 751 0430 (Office)
 - d. (701) 799 4867 (Cell)
 2. Primary Contact:
 - a. Ben Zeltinger - AIA
 - b. Ben.zeltinger@iconarchitects.com

1.04 CIVIL ENGINEER:

- A. Civil Engineer: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
1. MBN Engineering
 - a. 503 7th Street North Suite 200
 - b. Fargo, ND 58102
 - c. (701) 478 3321
 2. Primary Contact:
 - a. Ben Crandall
 - b. Ben.crandall@mbnengr.com

1.05 STRUCTURAL ENGINEER:

- A. Structural Engineer: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
1. ICON Architectural Group
 - a. 3187 Bluestem Drive, Suite 2
 - b. Fargo, ND 58078
 - c. (701) 364 4007

2. Primary Contact:
 - a. Tim Olson – PE
 - b. Tim.olson@iconarchitects.com

1.06 MECHANICAL ENGINEER:

- A. Mechanical Engineer: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 1. MBN Engineering
 - a. 503 7th Street North Suite 200
 - b. Fargo, ND 58102
 - c. (701) 478 3321
 2. Primary Contact:
 - a. Ian Blair – PE
 - b. ian.blair@mbnengr.com

1.07 ELECTRICAL ENGINEER:

- A. Electrical Engineer: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 1. MBN Engineering
 - a. 503 7th Street North Suite 200
 - b. Fargo, ND 58102
 - c. (701) 478 3321
 2. Primary Contact:
 - a. Prabha Kavasseri – PE
 - b. ian.blair@mbnengr.com

1.08 GEOTECHNICAL ENGINEER:

- A. Geotechnical Engineer: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 1. Material Testing Services
 - a. PO Box 634
 - b. Minot, ND 58702
 - c. (701) 852 5553
 2. Primary Contact:
 - a. Anthony Francis – PE
 - b. tonyfrancis@srt.com

END OF SECTION

**SECTION 000107
SEALS PAGE**

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Todd Blixt AIA ND Lic # 1700
2. Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record.



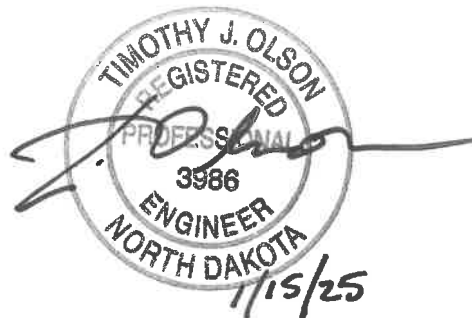
B. Civil Engineer:

1. Tony Eukel, P.E. PE-6864
2. Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record.
 - i. Responsible for Civil specifications, on drawings.



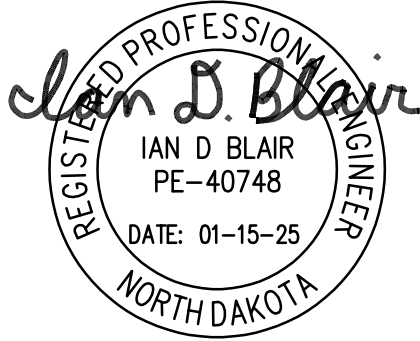
C. Structural Engineer:

1. Tim Olson, P.E. PE-3986
2. Responsible for Sections as indicated on the Specifications Index and as provided on drawings.



D. Mechanical Engineer:

1. Ian Blair, P.E. PE-40748
2. Responsible for Divisions 21, 22, 23.



E. Electrical Engineer:

3. Mike Berger, P.E. ND PE-4438
4. Responsible for Divisions 26, 27, 28



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END OF SECTION

**SECTION 001113
ADVERTISEMENT FOR BIDS**

Project: **Turtle Mountain Communications
Bottineau Office**
1109 11th St E
Bottineau, ND

Bid Date, Time, & Location: **Thursday, February 6, 2025 @ 2:00 PM CDT**
(Private Opening) Construction Engineers
ATTN: Lance Monson
200 North 69th Street, Grand Forks, ND 58203

Construction Manager: Construction Engineers
200 North 69th Street, Grand Forks, ND 58203

General Information

This project consists of 12,760 SF of new office and garage space on a green field site in Bottineau, ND. The project includes concrete, structural steel, rough and finish carpentry, membrane roofing, joint sealants, cement board siding, fluid applied air barrier, spray foam insulation, hollow metal doors, overhead doors, glass & glazing, gypsum board assemblies, tile, flooring, acoustical ceilings, painting, specialties, window treatments, pre-engineered metal building, mechanical, electrical, earthwork, asphalt paving, concrete paving, landscaping and irrigation, fencing, and utilities.

Construction shall begin in April 2025 and will be completed by April 2026. See section 01 3500 for the preliminary project schedule.

Construction Engineers is soliciting competitive "Lump Sum Bids" for **All Contract Categories**.

Pre-Bid Meeting

No formal pre-bid meeting will take place. Bidders are free to visit the open site as needed.

Autodesk Build Subscription

The use of Autodesk Build will be **required** on this project. Please visit the Autodesk Build website at <https://construction.autodesk.com/products/autodesk-build/> for more information. The construction manager will provide the subscription at no cost to the contractor.

Bidding Documents

Digital project bidding documents will be available for download on Thursday January 16th, 2025. Email TinaH@ConstructionEngineers.com for instructions on how to download a set of bid documents.

Should a bidder find a discrepancy or require clarification in the bidding documents, the bidder shall submit a request for clarification via email to the following individual: LanceM@ConstructionEngineers.com. Verbal clarifications will not be entertained. All requests for clarification must be submitted 72 hours prior to Bid Date. All plan holders will be notified of changes via email.

Instructions to Bidders

Bids may be emailed to LanceM@ConstructionEngineers.com, or hand delivered to the aforementioned address. Late bids may be rejected and returned.

Bids must be submitted on the Subcontractor Bid Form included with the bidding documents, and must show the total bid for all proposed items. CE reserves the right to request additional information to clarify the Bidder's financial capability, technical experience, and ability to successfully staff the project, and comply with safety and employment requirements.

1. All Bidders must be licensed for the highest amount of their Bids.
2. All Bidders, except a Bidder on municipal, rural, and industrial water supply project authorized for funding under Public Law No. 99-294 (100 Stat. 426; 43 U.S.C. 390a), must be licensed for the full amount of the bid, as required by Section 43-07-05. A copy of the Contractor's License or Certificate of Renewal thereof, issued by the Secretary of State, must be provided with the completed bid form.

Refer to Construction Engineers Instructions to Bidders and the Bid Form for additional requirements regarding requirements for Bonds.

Bid Opening

A private bid opening will take place. In the weeks following the bid opening, the Construction Manager will hold post bid interviews with qualified bidders. Any contract award shall be based on the amount of the total base plus any alternates the Owner may select and shall be awarded to the lowest, best qualified bidder. Separate contracts will be awarded for each trade specialty.

No bidder may withdraw their bid within forty-five (45) days after the actual date of opening thereof. The Construction Manager and the Owner reserve the right to reject any or all bids and to waive any or all formalities.

END OF SECTION

**SECTION 002113
INSTRUCTIONS TO BIDDERS**

PART 1 - GENERAL

1.1 THE WORK

- A. This project consists of 12,760 SF of new office and garage space on a green field site in Bottineau, ND.

1.2 SECURING DOCUMENTS

Copies of the proposed Contract Documents may be obtained upon the condition set forth in the Invitation to Bid from:

Construction Engineers
200 North 69th Street
Grand Forks, ND 58203
701-792-3200

1.3 BID FORM

In order to receive consideration, prepare bids in strict accordance with the following:

- A. Make bids upon the forms provided, properly signed and with all items filled out. Do not change the wording of the bid form, and do not add words to the bid form. Make no additional stipulation or qualify the bid in any other manner. Unauthorized conditions, or provisions attached to the bid may be cause for rejection of the bid. If alterations by erasure or interlineation are made for any reason, the bidder must initial them.
- B. A bid bond is not required. A performance and payment bond may be required on a case-by-case basis. Do not include the bond cost in your base bid. Provide the additional cost for providing a performance and payment bond on the associated line on the bid form. If you are unable to provide a bond annotate thus on the clarifications section of the bid form.
- C. Emailed or facsimile bid or modification of same (by same methods) will be considered. Bids received after the time fixed for receiving bids may not be considered.
- D. Address bids to the Construction Manager and deliver on or before the day and hour set for opening the bids.
- E. If an alternate bid is asked for on a type or method of construction, which a bidder does not desire to bid, the bidder shall insert the words "no bid" in the proper place. If an alternate does not involve a change in price from the base bid, the bidder shall insert the words "no change" in the proper place. Unauthorized or bidders' alternates may not be considered.
- F. If requested by the Construction Manager the Bidder shall, within ten days of notification of award of a Contract for the Work, submit the following information to the Construction Manager:
1. Proof of specified insurance
 2. Schedule of Values

3. Listing of the Work to be performed by the Bidder with his own forces and a list of names of the Sub-contractors or other persons or entities proposed for portions of the Work. Note that some information is required to be submitted with the Bid.

1.4 EXAMINATION OF DOCUMENTS AND SITE OF WORK

- A. Before submitting a bid, each bidder shall examine the Drawings, read the Specifications and all other proposed Contract Documents, and shall visit the site of the Work. Each bidder shall fully inform himself prior to bidding as to existing conditions and limitations under which the Work is to be performed and shall include in his bid a sum to cover the cost of items necessary to perform the Work as set forth in the proposed Contract Documents. No allowance will be made to a bidder because of lack of such examination or knowledge. The submission of a bid will be considered as conclusive evidence that the bidder has made such examination.
- B. No formal pre-bid meeting will take place as outlined in 00 1113 – Advertisement for Bids.
- C. Bidders shall use complete sets of Bidding Documents in preparing Bids; neither CM nor Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- D. CM or Architect in making copies of Bidding Documents available on above terms do so only for purpose of obtaining Bids on the documented Work and do not infer permission for any other use.
- E. Copies of standards referenced in Bidding Documents are available at the Architect's Office.

1.5 INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING

- A. If any person contemplating submitting a bid for the Work is in doubt as to the true meaning of any part of the proposed Contract Documents or finds discrepancies in or omissions from any part of the proposed Contract Documents, he may submit to the Architect a written request for interpretation thereof not later than three days before bids will be opened. The person submitting the request shall be responsible for its prompt delivery.
- B. Interpretation or correction of proposed Contract Documents will be made only by Addendum and will be delivered to each bidder of record or document holder. The CM or Architect will not be responsible for any other explanations or interpretations of the proposed Contract Documents. Each bidder is responsible for determining whether he has received an Addendum issued and acknowledge receipt on the Bid Forms submitted.
- C. It is the intent of these documents to produce a design or function (including all materials, parts, equipment systems, and details) to comply with the Americans With Disabilities Act of 2010 (ADA). Should any of the above portions or entities be specified or shown to contradict the ADA requirements, notify the Architect immediately and corrective measures will be issued by addendum.
- D. Any item specified by reference to a Commercial Standard, Federal Specification, trade association standard, or other similar standard, shall comply with the requirements for design, manufacture, and installation of the latest revision thereto in effect at the time of bidding.

Where this Specification requires a better quality than such standard, the Specification shall govern.

- E. Where a proprietary material or method is specified for one use, the intention is to establish a standard of quality, performance or size and not to exclude another product of equal merit as determined by the Architect.
- F. For proprietary items, bids shall be based on items named in the Specification, or on items, which the Architect designates, by Addendum as an approved equal. An item named in the Specification or by Addendum will be acceptable only when it meets all other requirements of the Specifications, including the specification of the manufacturer as of the date of bidding. Requests for the approval of an item as equal will not be considered unless the Architect receives sufficient data for evaluation prior to bid opening. The Architect will consider delivery time and availability of service as well as the product itself, in acting on a request for approval under provision of this paragraph.
- G. Contractors using materials not approved by the Architect and not specifically mentioned by make and model may have these products rejected at the time of submittals.
- H. When a specification approves a manufacturer, it does not grant approval of all products by that manufacturer. Bidders are required to submit exact details of make and model prior to bidding. Reference to approved manufacturers indicates a general familiarity by the Architect of that vendor's products but does not grant specific approval.
- I. Where the Contractor chooses to use an item approved as above but other than the one shown on the details or specified in detail, he shall be responsible for coordinating any necessary changes in other Work and shall bear the cost of such changes.
- J. No substitutions will be considered after the Contract award unless specifically provided in the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SUBCONTRACTOR BID FORM

Project: Turtle Mountain Communications
Bottineau Office
1109 11th St E, Bottineau, ND

Submitted By: Company: _____
Address: _____
Bidding Contact: _____
Email Address: _____
Phone: _____ Fax: _____

Submitted To: Lance Monson [email to:LanceM@ConstructionEngineers.com](mailto:LanceM@ConstructionEngineers.com)
Construction Engineers Inc. Fax: 701-772-1808
200 North 69th Street
Grand Forks, ND 58203

OFFER:

Having examined the place of work and all matters referred to in the Contract Documents prepared by ICON Architectural Group, for the above referenced project, we, the undersigned, hereby offer to enter into a Contract for furnish all labor, materials, equipment and services required to perform the work associated with the following:

BASE BID (Including sales/use tax):

Contract Category _____ Lump Sum \$ _____
Contract Category _____ Lump Sum \$ _____
Contract Category _____ Lump Sum \$ _____

Combined Bid for Multiple Contract Categories (Including sales/use tax):

Contract Category _____ & _____ Lump Sum \$ _____
Additional Cost to provide a Performance & Payment Bond \$ _____

ALTERNATES:

Alternate 1 - Concrete Paving in Lieu of Asphalt (ADD/DEDUCT) \$ _____

Alternate 2 – Add Five Type C Windows (ADD/DEDUCT) \$ _____

Voluntary Alternate (ADD/DEDUCT) \$ _____

Description _____

UNIT PRICES:

Unit Price #1 - Remove/Recompact Uncontrolled Fill \$ _____ /CY

Unit Price #2 - Removal of unusable fill/Import replacement \$ _____ /CY

Unit Price #3 - Topsoil \$ _____ /CY

SUBCONTRACTOR BID FORM (continued)

For Material Only Bids – Attach additional information to this bid form as needed.

In submitting this bid, it is understood that the Construction Manager and the Owner reserve the right to hold all bids for a period of 45 days after bid date and to reject any and all bids and waive any formalities or irregularities.

CLARIFICATIONS:

ADDENDA:

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the above pricing.

Addendum # _____ Dated _____ Addendum # _____ Dated _____
Addendum # _____ Dated _____ Addendum # _____ Dated _____

ACKNOWLEDGEMENTS *(for labor & material bids only -- does not apply to material only bids):*

Initial to acknowledge the Contract Documents noted below have been reviewed:

Subcontract Agreements _____ Initials Attachment A – Project Safety Requirements _____ Initials

BY SIGNING THIS DOCUMENT I CERTIFY THAT I AM AN OWNER OR OFFICER OF THE COMPANY, AND I SWEAR THAT MY COMPANY MEETS ALL THE CRITERIA LISTED ABOVE.

Dated this _____ day of _____ 2025.

Company: _____

Signature of Authorized Officer: _____

Printed Name: _____

Title: _____

**SECTION 004322
UNIT PRICES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- C. List of Unit Prices: A schedule of unit price is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price #1 – Provide a price per cubic yard for the removal and re-compaction of uncontrolled fill materials encountered in the completion of the project, over and above the quantities anticipated in the execution of the work as described in the Geotechnical report and construction documents. Include all labor, material, taxes, equipment and other incidental items related to the placement of the fill.
- B. Unit Price #2 – Provide a price per cubic yard for the removal of unusable fill materials and the import of granular fill to replace the unusable fill, over and above the quantities anticipated in

the execution of the work as described in the Geotechnical report and incidental items related to the placement of the fill.

- C. Unit Price #3 – Provide a price per cubic yard for the import of additional topsoil materials over and above the quantities anticipated in the construction documents. Include all labor, material, taxes, equipment and other incidental items related to the placement of the topsoil.

END OF SECTION

**SECTION 005220
OWNER - CONSTRUCTION MANAGER AGREEMENT**

PART 1 - GENERAL

1.1 LIST OF CONTRACT FORMS

- A. Standard Form or Agreement Between Owner and Design-Builder – Lump Sum: DBIA Contract Document No. 525 has been modified by the Owner and Construction Engineers to reflect Project specific requirements and is available for inspection at the office of Construction Engineers.

- B. Standard Form of General Conditions of Contract Between Owner and Design-Builder: DBIA Document No. 535 has been modified by the Owner and Construction Engineers to reflect Project specific requirements and is available for inspection at the office of Construction Engineers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 007000
GENERAL CONDITIONS – CMAR**

PART 1 GENERAL

1.01 SUMMARY

- 1.1 The "General Conditions of the Contract for Construction", AIA Documents A201, 2017 edition, Articles 1 through 15 inclusive, shall be part of this Contract and is hereby made part of this Specification. (To the same extent as if it were bound in or herein written out in full).

The document is available at the office of the Architect for inspection prior to the bids and will be made available to the successful bidder upon request.

- 1.2 The following supplements, included in this Section, modify, delete from, and/or add to the General Conditions.
- A. Section 008000, Supplementary Conditions, has further changes and additions to the standard printed documents.
 - B. All Articles, or portions thereof, which are not specifically modified, deleted, or superseded hereby, remain in full effect.
 - C. These General Conditions also may be supplemented elsewhere in the Contract Documents by provisions located in, but not necessarily limited to, Division 1 of the Specifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 007300
SUPPLEMENTARY CONDITIONS – CMAR**

PART 1 GENERAL

1.01 SUMMARY

- A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 00 72 00 - General Conditions and other provisions of the Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.
- B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 RELATED SECTIONS

- A. Section 00 72 00 - General Conditions.
- B. Section 01 42 16 - Definitions.

1.03 MODIFICATIONS TO THE GENERAL CONDITIONS

ARTICLE 1 - GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

Add the following:

- 1.1.3.1 The term "provide" shall mean furnish and install in place.
- 1.1.5.1 The general character and scope of the Work is shown by the Drawings. Where a portion of the Work is fully drawn and the remainder is merely indicated, the portion fully drawn shall apply to all similar parts of the Work.
- 1.1.5.2 Figured dimensions on the Drawings shall be followed in preference to scaled measurements on the Drawings.
- 1.1.6.1 Where Specifications are abbreviated type, they indicate complete sentences in the same manner as when a note occurs in the Drawings. Omissions of words such as "the Contractor shall" and "as shown on the Drawings" is intentional. The words "shall" or "shall be" are to be supplied by inference.
- 1.1.6.2 Where a number is listed in the Specifications (as for gauges, weights, temperatures, amounts of time, etc.), the number shall be interpreted as that or better.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following:

- 1.2.4 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.
- 1.2.5 As experienced Contractors and Subcontractors, it is assumed each Contractor and Subcontractor understands not all components may be shown on the Drawings including, but not limited to, fasteners, connectors and incidental supports. This shall not relieve the Contractors or Subcontractors from providing all materials, equipment, fasteners, and incidental components as required or a complete installation in accordance with the design intent.

ARTICLE 3 - CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Modify the original paragraph as follows:

3.2.1 At the end of the sentence add “and geotechnical report, if any”.

3.4 LABOR AND MATERIALS

Add the following:

- 3.4.1 In the first sentence after “and other facilities” add “, whether temporary or permanent...” and add sentence at the end of the paragraph “Contractor shall coordinate with Section [01 55 00] Temporary Facilities and Controls, to ensure Contractor is responsible for said costs.”
- 3.4.2.1 After the Contract has been executed, the Owner and Architect may consider requests for the substitution of products in place of those specified. The Owner and Architect may, but are not obligated to, consider only those substitution requests that are in full conformance with the conditions set forth in the General Requirements (Division 1 of the Specifications). By making requests for substitutions, the Contractor:
 - .1 represents that it has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to the product specified;
 - .2 represents that it will provide the same warranty for the substitution as it would have provided for the product specified;
 - .3 certifies that the cost data presented is complete and includes all related costs for the substituted product and for Work that must be performed or 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;
 - .4 agrees that it shall, if the substitution is approved, coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects; and
 - .5 represents that the request includes a written representation identifying any potential effect the substitution may have on the Project’s achievement of a Sustainable Measure or the Sustainable Objective.
- 3.4.3 Add sentence at the end “This provision shall apply to contractors, subcontractors, and their respective employees, agents, and consultants.”
- 3.4.4 No trade shall commence Work until conditions are satisfactory for carrying out the Work properly, and surfaces to be covered are suitable.
- 3.4.5 Manufacturer’s printed instructions covering details of installation shall be followed where not in conflict with these Specifications. If there is a conflict, notify the Architect and obtain Architect’s approval before proceeding.
- 3.4.6 Completed Work shall be left plumb, level, true to line or plane, anchored securely in place, and free from damage.
- 3.4.7 Unless otherwise called for, all pieces of material shall be as large a stock size as is in conformity with standard good practice of the trade.
- 3.4.8 Except where in conflict with the Specifications, current manufacturer’s printed instructions of herein specified proprietary products are made part of the Specifications.

- 3.4.9 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.
- 3.4.10 The Contractor shall provide all incidental materials and components including, but not limited to, fasteners, connectors, incidental supports and other components of construction as required for complete installation in accordance with the design intent.

3.5. WARRANTY

Add the following:

- 3.5.1.1 The Contractor further warrants that all products, materials and equipment provided under the Contract are [asbestos-free] [zero percent Asbestos containing] as defined under current EPA Guidelines, and that they do not contain any other materials currently known to be hazardous.

Add the following:

- 3.5.3 The Contractor shall guarantee and maintain the stability of all work and materials and keep same in reasonable repair and condition for the period of one (1) year from the date of final acceptance of the Work but with respect to any part of the Work which the Owner takes possession of prior to final acceptance, the guarantee shall continue for a period of one year from the date the Owner takes possession. This is in addition to any manufacturer's warranty specified.
- 3.5.4 Defects of any kind, due to faulty work or materials appearing during the above-mentioned period must be promptly made good by the Contractor at his own expense to the entire satisfaction of the Owner and Architect. Any such construction and repairs shall include the costs of all damages to the finish or furnishings of the building resulting from the original defect or repairs to the building. Where equipment is required to be replaced, the one-year warranty shall be reinstated for that piece of equipment from the date of replacement.
- 3.5.5 The guarantee, as provided in paragraph 3.5.4, does not apply to injuries or damages occurring after final acceptance due to "acts of God," fire, violence, abuse, or carelessness of other Contractors or agents of the Owner; however, the Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the Contractor's guarantee nor relieving the Contractor of the Contractor's responsibilities during the guarantee period.
- 3.5.6 The guarantee, as provided in paragraph 3.5.4, shall be extended if other guarantees for different lengths of time are specifically called for in the Contract Documents or if manufacturer's standard warranties extend for a longer period.

3.7 PERMITS, FEES AND NOTICES

Add the following:

- 3.7.2.1 When the Contract Documents require Work better than that required by statute, the Contract Documents shall govern.
- 3.7.4 Modify the end of the first sentence to reflect "...7 days after first observance of the conditions" and remove "...14 days...".

Modify the original paragraph as follows:

- 3.9.3 Replace second sentence with: The Contractor shall not change the superintendent during the progress of the project without the Owner's and Architect's written consent, which shall not unreasonably be withheld or delayed.

3.10 CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

Add the following:

- 3.10.1 Submit in accordance with Section 01 33 00.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Replace the original paragraph in its entirety with:

- 3.11 See Division 01, Section [01 33 10] of the Project Manual.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

Add the following:

- 3.12.6 Add sentence at end of paragraph "Prior to submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor shall stamp the submittal, which verifies compliance of this section. If any submittal is received by the Architect without a stamp, the submittal will be immediately rejected without additional time or cost allowance."
- 3.12.6.1 If the Contractor or any Subcontractor uses a material, product or piece of equipment which requires modification(s) to any other portion of the Work, including mechanical and electrical Work, the Contractor or Subcontractor using that material, product or piece of equipment shall be responsible for coordinating all required modifications and shall bear the full cost of such modifications.

3.15 CLEANING UP

Add the following:

- 3.15.1.1 The Contractor and Subcontractors shall clean all portions of the Work in accordance with Section 01 74 00 and as indicated on any punch lists. Final payment shall not be made until all cleaning has been accepted by the Architect.

ARTICLE 4 - ARCHITECT

4.2 ADMINISTRATION OF THE CONTRACT

Modify the original paragraph:

- 4.2.3 Add sentence at end: The Architect will not be responsible for the acts or omissions of the Owner.

ARTICLE 5 - SUBCONTRACTORS

5.1 DEFINITIONS

Add the following:

- 5.1.3 All Subcontractors are bound to the terms of the General and Supplementary Conditions.

- 5.2.1 After "Unless otherwise stated in the Contract Documents," add "or required by state law".
- 5.2.4 At the end of the sentence, add "Should a substitution be required or necessary, the Contractor shall promptly notify the Owner and Architect, and the Owner and Architect shall be provided the opportunity to review and approve the new subcontractor, person, or entity. Owner and Architect shall have 7 days to review and comment and/or approve, which approval should not be unreasonably withheld."

ARTICLE 7 - CHANGES IN THE WORK

Add the following:

- 7.1.4 All proposals shall, at a minimum, include detailed breakdown and indicate the terms enumerated below. Item (a) constitutes the cost of labor, and items (b), (c), and (d) constitute the basic costs referred to under this Article 7.
- (a) Labor costs, itemized by each trade involved, showing the hourly rates for each, and the hours required for the change. Labor rates shall be the same for extra and credit computations and shall be the actual rate paid the workmen, plus contractor's burden on labor, which shall be only the actual costs of fringe benefits, taxes on labor, worker's or workmen's compensation, insurance on labor as affected by payroll, unemployment taxes and insurance, including FICA and FUTA.
 - (b) Quantities of materials, equipment and supplies, at their actual cost, with unit costs indicated, plus applicable sales tax.
 - (c) The cost of subcontracted work, computed in the same way as provided for under this subparagraph.
 - (d) Overhead, profit or commission added after the above computations are complete. Such overhead, profit or commission shall be computed in accordance with the provisions of subparagraph 7.1.5.
- 7.1.5 Maximum allowances for Subcontractor's overhead and profit shall be as follows, expressed as a percentage of the basic cost of the change:
- For Subcontractors: a. 15% of the net cost of the additional Work.
- Overhead and profit shall include all bond premiums (if applicable), and will not be allowed on labor costs if overhead and profit is already included in hourly billing rate.
- 7.1.6 For proposed changes in the Work on the lump sum or time and material methods, the costs shall be determined as provided in this subparagraph. The Contractor shall submit an itemized list of quantities with the applicable unit costs and extended price for each, in such form and detail as required by the Architect.

7.2 CHANGE ORDERS

Add the following:

- 7.2.2 Neither the Owner nor the Architect are responsible to give Notice of Change Orders to the surety.

7.3 CONSTRUCTION CHANGE DIRECTIVES

Modify the original paragraph:

- 7.3.2 At the end of the sentence Add "or as deemed necessary by the Architect".
- 7.3.4 At the end of the first sentence replace "...a reasonable allowance for overhead and profit." with "...allowances for overhead and profit as indicated in 7.1.5."

ARTICLE 8 - TIME

8.1 DEFINITIONS

Add the following:

- 8.1.3.1 Minor corrective Work and the replacement of defective Work or materials, and the adjustment of control apparatus, will not delay the determination that the Contract is Substantially Complete.
- 8.1.3.2 The date of Final Completion is the date certified by the Architect in accordance with Paragraph 9.10.2.

8.3 DELAYS AND EXTENSIONS OF TIME

Add the following:

- 8.3.1.1 The following will not be considered justifications for extension of time unless due to one of the causes stated within this Article 8:
 - (a) Delay caused by Subcontractors or Supplier except if the Supplier goes out of business and another Supplier cannot be found in time to meet the schedule.
 - (b) Shortage of workmen.
- 8.3.1.2 Change Orders for extension of Contract Time shall be considered only under the following conditions or circumstances:
 - .1 As indicated in Paragraph 8.3.1. The burden of proof to substantiate the extension of time shall rest with the Contractor, including evidence that the cause was beyond his control. The Contractor shall be deemed to have had control of the supply of labor (except in the case of organized labor disputes), materials, equipment, methods, and techniques, and of the Subcontractors.
 - .2 A delay in the progress of the Work actually occurred as a result of one of the valid causes for time extension.
 - .3 Unusual delay in delivery solely due to a delay in transportation. An extension of time shall not be considered when delay in delivery is due to improperly scheduled delivery, or when an order has not been promptly and properly placed.
 - .4 Abnormal weather conditions. The Contractor shall consider the location of the Project, and shall recognize the existence of variations from average climatic conditions. Foul weather in and of itself shall not be a valid cause for a time extension. Time extensions resulting from abnormal weather shall not be considered unless a significant deviation from average seasonal climatic conditions occurred for an extended period of time, and the progress of the Work was delayed to a significant extent. The climatic conditions before and after the period for which the delay is sought shall be evaluated.
 - .5 Changes in the Work which significantly affect the progress of the Work. When the anticipated delay can be determined the extension will be made when the Change in Work is authorized by the Owner. When the anticipated delay cannot be determined, the Contractor shall estimate the additional time required, and a mechanism for all parties to determine the allowable delay. In such a case, the Architect will determine the time extension and the Contract Time adjusted accordingly by Change Order. For changes in the Work which affect only a portion or Phase of the entire project, the Owner reserves the right to grant a time extension only for that portion or Phase affected by the Change.
 - .6 Labor disputes except for lockouts over which the Contractor has control. The amount of time extension shall not be longer than the actual dispute period plus a reasonable time for mobilization, and such extension may be less than the actual

dispute period depending on the effect the dispute had upon the progress of the Work.

- .7 Unavoidable delays such as damage caused by severe weather, fire or other casualty to the Work; remediation of contaminants, pollutants, or hazardous materials or substances discovered after award of the Contract; litigation including without limitation bankruptcy proceedings; the acts of any federal, state or local government unit that directly result in delays; and other delays outside the control of the Party claiming the delay.
- .8 Delays caused by Subcontractors shall be considered only under the conditions noted above.

- 8.3.1.3 Time extensions shall not be granted as a result of delays caused by improper scheduling, or by failure of the Contractor to have Shop Drawings or other required submittals submitted in sufficient time for review.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

Modify the original paragraph:

- 9.1.2 Add sentence at end: "The costs for overhead, profit and commission shall be determined in accordance with the provisions of subparagraph 7.1.5."

9.2 SCHEDULE OF VALUES

Add the following paragraph:

- 9.2.1 For every specification section, Contractor shall detail the cost for labor and material prior to submitting to the Architect for review.

9.3 APPLICATIONS FOR PAYMENT

- 9.3.4 Progress payments shall be made monthly upon application, in the amount of 90% of the Work completed and materials described under 9.3.2. For a Contract of over \$100 thousand, the Architect may authorize the payment of 100% of the amount completed after a total of 5% of the Contract amount has been retained, providing progress on the Work is in accordance with or ahead of the Contractor's construction schedule and is satisfactory to the Architect and if the Contractor has filed a Consent of Surety with the Architect.

9.8 SUBSTANTIAL COMPLETION

Add the following:

- 9.8.1 Minor corrective Work, the replacement of defective Work or materials, and the adjustment of control apparatus will not delay the determination of Substantial Completion.
- 9.8.2 Minor punch list items that do not interfere with using the Work as intended may be corrected between Substantial Completion and Final Completion.

9.10 FINAL COMPLETION AND FINAL PAYMENT

Modify the original paragraph as follows:

- 9.10.2 After "...or Subcontractor warranties," DELETE "and (6)" and REPLACE WITH ",(6) written certification from Contractor in accordance with Final Inspection requirements of [Section 01 77 00], (7) all Contract Closeout submittals required by [Section 01 77 00], each submittal having been approved by the Architect, and (8)".

ARTICLE 10 - PROTECTION OF PERSONS & PROPERTY

10.3 HAZARDOUS MATERIALS

Modify the original paragraph as follows:

- 10.3.1 In the second sentence add "lead-containing materials" after "asbestos".

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR'S INSURANCE AND BONDS

Modify the original paragraph as follows:

- 11.1.1 Replace paragraph with: The Contractor shall purchase and maintain the following insurance for the duration of the project performed under the Agreement and any additional period as described in the Agreement between the Owner and Contractor. Commercial General Liability with policy limits of not less than **XX** for each occurrence and **XX** in the aggregate for bodily injury and property damage. Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor which policy limits of not less than **XX** per accident for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles, along with any other statutorily required automobile coverage. The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided that such primary and excess or umbrella liability insurance policies result in the same or greater coverage as the coverages required, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers. Worker's Compensation at statutory limits and Employers Liability with policy limits not less than **XX** each accident, **XX** each employee, and **XX** policy limit. Professional Liability covering negligent acts, errors, and omissions in the performance of professional services, with policy limits of not less than **XX** per claim and **XX** in the aggregate. Said insurance must be from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, including its agencies and officers, Architect, and Architect's consultants shall be named as additional insured under the Contractor's commercial general liability and automobile liability policies or as otherwise described in the Contract Documents.
- 11.1.2 Replace the first sentence with: The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required in the Agreement or elsewhere in the Contract Documents, covering the faithful performance of the Contract and the payments of all obligations arising thereunder.
- 11.1.3 Replace paragraph with: The Contract will not be executed by the Owner until the Owner has received, from the Contractor, the properly executed surety bonds specified in AIA A133-2017, or as amended, Exhibit A Insurance and Bonds.

11.5 ADJUSTMENT AND SETTLEMENT OF INSURED LOSS

Modify the original paragraph as follows:

- 11.5.1 Replace the text with: A loss insured under the property insurance required by the agreement shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Subparagraph 11.5.2. The Contractor shall pay their subcontractors and Owner their just shares of insurance proceeds received by the Contractor and Owner shall make payments to the Architect and their consultants in similar manner.
- 11.5.2 Replace the text with: Prior to settlement of an insured loss, the Contractor shall notify the Owner of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Owner shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Owner does not object, the Contractor shall settle the loss and the Owner shall be bound by the settlement and allocation. Upon receipt, the Contractor shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Owner timely objects to either the terms of the proposed settlement or the allocation of proceeds, the Contractor may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

OR

ARTICLE 12 - UNCOVERING AND CORRECTION OF WORK

No supplement.

ARTICLE 13 - MISCELLANEOUS PROVISIONS

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.2 TERMINATION BY THE OWNER FOR CAUSE

Modify the original paragraph as follows:

- 14.2.1.2 At the end of the Subparagraph, before semi-colon, Add “or in accordance with the Contract Documents”.

Add the following:

- 14.2.1.5 files a bankruptcy petition or has a bankruptcy action commenced against it that is not discharged within 30 days of commencement of same, makes an assignment for the

benefit of its creditors, has a receiver appointed to manage the Contractor's assets or otherwise becomes insolvent;

- 14.2.1.6 fails to maintain schedules as required by the Contract Documents, or fails to comply in a material way with design requirements of the Contract Documents, or persistently fails to perform the Work in accordance with the Contract Documents.

Modify the original paragraph as follows:

- 14.2.4 Replace paragraph with: If the unpaid balance of the Contract Sum exceeds the direct and indirect consequential costs of completing the Work (including but not limited to fees and charges of engineers, architects, attorneys and other professionals and court and arbitration costs), and other damages incurred by the Owner, such excess will be paid to the Contractor. If such costs and damages exceed such unpaid balance, the Contractor shall pay the difference to the Owner. Such costs incurred by the Owner will be approved as to reasonableness by the Architect, but when exercising any rights or remedies under this paragraph, the Owner shall not be required to obtain the lowest price for the Work performed. This obligation to payment shall survive termination of the Contract.

ARTICLE 15 - CLAIMS AND DISPUTES

Add the following:

- 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 each 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.

AIA DOCUMENT A101-2017 EXHIBIT A

ARTICLE A.1 – GENERAL

Add: Reference to "all-risks" in this document shall mean builder's risk policy.

ARTICLE A.2 – OWNER'S INSURANCE

A.2.3 REQUIRED PROPERTY INSURANCE

Modify the original paragraph as follows:

- A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be

maintained until Substantial Completion and thereafter as provided in Section A.2.3,1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Architect, Engineers Contractor, Subcontractors, and Sub subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees. This insurance is not intended to cover machinery, tools or equipment owned or rented by the Contractor that are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage per Article A.3.3.2.5 for owned or rented machinery, tools or equipment which shall be subject to the provisions of the General Conditions, Article 11.3 Waivers of Subrogation.

ARTICLE A.3 - CONTRACTOR'S INSURANCE AND BONDS

A.3.1 General

Modify the original paragraph as follows:

- A.3.1.1 Replace the third sentence with: The certificates will show the Owner and Architect as additional insured on the Contractor's Commercial General Liability and umbrella liability policy or policies.

Add the following paragraph:

- A.3.1.1.1 Proof of workmen's compensation insurance coverage shall be a copy of certificate of premium payment and proof of other insurance coverage shall be fully descriptive standard AIA or ACCORD Certificate of Insurance. The Certificate of Insurance portrays the Insurance Agent's description of coverages provided the Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 007310
FORM OF AGREEMENT BETWEEN CONSTRUCTION MANAGER AND SUBCONTRACTOR OR
MATERIAL SUPPLIER**

PART 1 - GENERAL

1.1 LIST OF CONTRACT FORMS

- A. Subcontract Agreement - Construction Engineers intends to award multiple trade contracts using Construction Engineers' Standard Subcontract Agreement in accordance with the work scope categories issued in Section 01 1101. Example Labor and Material agreement is included in Section 00 7310.1
- B. Material Supplier Agreements – Construction Engineers intends to award material supplier contracts in accordance with work scope categories issued in Section 01 1101. Example agreement for Material Suppliers is included in Section 07310.2

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION



STANDARD SUBCONTRACT AGREEMENT
LABOR AND MATERIALS

22##-##

Prepared by Construction Engineers, Inc.

THIS SUB-CONTRACT, made this ##th day of Month, 20##, by and between CONSTRUCTION ENGINEERS, INC, PO BOX 13378, 200 NORTH 69th STREET (58203), GRAND FORKS, ND 58208-3378, hereinafter called the Construction Manager, and COMPANY NAME, ADDRESS, CITY, STATE ZIP, hereinafter called the Sub-Contractor.

WHEREAS, the Construction Manager has heretofore entered into a contract with OWNER NAME, ADDRESS, CITY, STATE ZIP, hereinafter called the Owner, to perform Construction Management services, to perform certain labor and furnish certain material for the erection and completion of PROJECT NAME, ADDRESS, CITY, STATE ZIP, hereinafter called the Project, pursuant to plans and specifications prepared by ARCHITECT/ENGINEER, ADDRESS, CITY, STATE ZIP, hereinafter called the Architect, which contract consisting of the following: Proposal; Contract; Specifications dated MM/DD/YY; Plans dated MM/DD/YY; General Conditions; Special Conditions; Bond (if any); Attachment(s): A - Project Safety Requirements, B - Specification Log, C - Drawing Log, D - Project Schedule, and E - Subcontractor Billing Procedures; Addenda or Amendment(s): N/A; and Alternate(s): N/A to any of the foregoing, are hereinafter collectively referred to as the General Contract; and

WHEREAS, the Construction Manager has made available to the Sub-Contractor all of the above documents, except that a blank proposal form and a blank contract form have been made available in lieu of completed forms; and

WHEREAS, the above have been carefully examined by the Sub-Contractor.

THE SUB-CONTRACTOR AGREES AS FOLLOWS:

I. To furnish all labor, material, and equipment necessary or required to perform all the work necessary or incidentally required for that part of the construction of the Project, as follows:

Project Specific Inclusions:

SCOPE OF WORK

Total Contract Amount \$ ###,###.##

II. To pay for all materials, skill, labor and instrumentalities used in, or in connection with the performance of this Sub-Contract, when and as bills or claims therefore become due, and to save and protect the Project, the Owner, and the Construction Manager from all claims and mechanics' liens on account thereof, and to furnish satisfactory evidence to the Construction Manager when and if required, that he has complied with the above requirements. This provision shall not be construed as a waiver of the right of the Sub-Contractor to file and enforce a lien claim against the Owner in the event of the Construction Manager's failure to pay the Sub-Contractor.

III. To begin the work herewith contracted for as soon as the Project upon which the work is to be done is ready for such work or, in any event, within 3 calendar days after being notified by the Construction Manager to do so, and to complete the several portions of the whole thereof within the time or times following, namely:

Schedule

- Coordinate and complete work in accordance with the attached project schedule dated **MM/DD/YY.**
- Perform the segments of your work as directed and as specified to allow overall project substantial completion by **MM/DD/YY.**

Shop Drawings / Submittals - ELECTRONIC COPIES ARE PREFERRED

- Within 5 calendar days of receipt of this contract, submit shop drawings (1 electronic copy) to **NAME@ConstructionEngineers.com** and/or product data and samples and/or color charts as required by the specifications of this subcontract for all portions of work.
- Submit only clear, easy to read, electronic files (no scanned copies - we need files that are printed directly to a .pdf file). Please inform your manufacturers of this requirement.
- Submit shop drawings/product data for only materials that comply with the plans, specifications and addenda. Your company shall be held liable for products that are not compliant.
- Thoroughly review all submittals prior to forwarding them to Construction Engineers.
- **NOTE: WHEN SUBMITTING PRODUCT DATA SHEETS FOR APPROVAL, YOU MUST CIRCLE (OR SOMEHOW IDENTIFY) THE APPLICABLE OPTIONS / SIZES / FEATURES THAT APPLY TO THIS PRODUCT.**

Pay Requests

- Pay Requests are due in the Construction Engineers main office (email to **Accounting@ConstructionEngineers.com**) by the **25th** of each month. Pay Requests received after this date will be processed in the following month. No future reminders will be issued regarding the timely submission of Pay Requests.

Liquidated Damages

- It is hereby agreed that damages arising from the non-fulfillment of this contract in the required time, shall be deducted from the contract price, and be as liquidated damaged and not in the nature of a penalty and shall be **###.##** dollars per calendar day.

IV. To proceed with the work in the sequence directed by the Construction Manager and to abide by the Construction Manager's decision as to the allotment of all storage and working space on the Project.

V. That no extension of time of performance of this Sub-Contract shall be recognized by the Construction Manager without the written consent of the Construction Manager.

VI. To save harmless the Construction Manager and all other sub-contractors from any and all loss or damage (including without limiting the generality of the foregoing, legal fees and disbursements paid or incurred by the Construction Manager to enforce the provisions of this paragraph) occasioned by the failure of the Sub-Contractor to carry out the provisions of this Sub-Contract unless such failure results from causes beyond the control of the Sub-Contractor.

VII. To obtain, effect, maintain and pay for workmen’s compensation insurance that may be required by the General Contract or by law, and general liability and automobile liability insurance protecting the Sub-Contractor against claims for bodily injury, death or damage to property and for such other risks as are specified below occurring upon, or in connection with, the execution of work covered under this Sub-Contract. Such insurance shall indemnify the Construction Manager, Owner, Architect and the other sub-contractors from all accidents or occurrences arising out of Sub-Contractor’s operation (Architect will be added as an additional insured in regards to bodily injury and property damage only) with limits and in amounts at least equal to the greater of those specified in the General Contract, or other specified below:

General Liability	Automobile Liability	Workmen's Compensation
\$2,000,000 General Aggregate	\$1,000,000 Each Accident Including Owned, Hired, & Non-Owned Vehicles	(Out of State) \$500,000 Each Accident
\$2,000,000 Completed Operations Aggregate	Umbrella- Excess Liability	\$500,000 Each Disease
\$1,000,000 Each Occurrence	\$1,000,000 Each Occurrence	\$500,000 Each Employee
\$1,000,000 Personal & Adv Injury	\$1,000,000 Aggregate	(North Dakota)
\$100,000 Fire Damage	Professional Liability (if applicable)	Statutory Limits
\$5,000 Medical	\$1,000,000 Per Claim	

Said insurance shall be in form and issued by a company or companies having an A.M. Best rating of A+ or higher; with **Construction Manager and Owner named as additional insured (per CG 20 10 and CG 20 37 or equivalent forms), with additional insured portion including products completed operations on a primary and non-contributory basis and waiver of subrogation in favor of contractor and owner.** Sub-Contractor shall furnish to the Construction Manager, when and as often as requested, satisfactory evidence that it has complied with this requirement; and shall **obtain and furnish to the Construction Manager an ACORD certificate by the insurance company issuing such policies.** Such insurance shall provide that **Construction Manager shall receive thirty (30) days prior written notice of any alteration, modification or cancellation thereof.** Nothing contained herein shall be construed to limit Sub-Contractor’s liability to the insurance limits set forth above and at all times hereunder, Sub-Contractor agrees that certificates of insurance required hereunder shall be provided to Construction Manager within ten days of the date of signing of this Agreement. **All insurance policies required hereunder must remain in effect until the expiration of the statute of repose in the State the project is located in.**

The Sub-Contractor agrees to assume entire responsibility and liability for all damages or injury to all persons, whether employees or otherwise, and to all property, arising out of, resulting from or in any manner connected with, the execution of work provided for in this Sub-Contract or occurring or resulting from the use by the Sub-Contractor, his agents or employees, of materials, equipment, instrumentalities or property, whether the same be owned by the Construction Manager, the Sub-Contractor or third parties and the Sub-Contractor agrees to indemnify and save harmless the Construction Manager, his agents and employees from all such claims including, without limiting the generality of the foregoing, claims for which the Construction Manager may be, or may be claimed to be liable, and legal fees and disbursements paid or incurred to enforce the provisions of this paragraph, and the Sub-Contractor further agrees to obtain, maintain and pay for such general liability insurance coverage as will insure the provisions of this paragraph.

The following is an *example* of an acceptable certificate of insurance. In the event that the following certificate contradicts written insurance requirements, written requirements shall take precedence:

CERTIFICATE OF INSURANCE							DATE (MM/DD/YY)
PRODUCER <i>SAMPLE CERTIFICATE</i> Insurance Agency Name & Address				THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.			
				COMPANIES AFFORDING COVERAGE			
				COMPANY A			
				COMPANY B			
				COMPANY C			
				COMPANY D			
				COMPANY B			
				COMPANY C			
				COMPANY D			
COVERAGES THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.							
INS LTR	TYPE OF INSURANCE	ADD'L INSD	SUBR WVD	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YYYY)	POLICY EXPIRATION DATE (MM/DD/YYYY)	LIMITS
#	GENERAL LIABILITY <input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <div style="font-size: x-small; margin-left: 20px;"> <input type="checkbox"/> CLAIMS MADE <input checked="" type="checkbox"/> OCCUR </div> GEN'L AGGREGATE LIMIT APPLIES PER <input type="checkbox"/> POLICY <input checked="" type="checkbox"/> PROJECT	X	X	#####	MM/DD/YYYY	MM/DD/YYYY	GENERAL AGGREGATE \$ 2,000,000 PRODUCTS-COMP/OP AGG \$ 2,000,000 PERSONAL & ADV INJURY \$ 1,000,000 EACH OCCURRENCE \$ 1,000,000 FIRE DAMAGE (Any One Fire) \$ 100,000 MED EXP (Any One Person) \$ 5,000
#	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO <input checked="" type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> HIRED AUTOS <input checked="" type="checkbox"/> NON-OWNED AUTO	X	X	#####	MM/DD/YYYY	MM/DD/YYYY	COMBINED SINGLE LIMIT (each accident) \$ 1,000,000 BODILY INJURY (Per Person) \$ BODILY INJURY (Per Accident) \$ PROPERTY DAMAGE (Per Accident) \$
#	<input checked="" type="checkbox"/> UMBRELLA LIABILITY <input checked="" type="checkbox"/> EXCESS LIABILITY <input checked="" type="checkbox"/> OCCUR <input type="checkbox"/> CLAIMS MADE	X	X	#####	MM/DD/YYYY	MM/DD/YYYY	EACH OCCURRENCE \$ 1,000,000 AGGREGATE \$ 1,000,000
#	WORKMAN'S COMPENSATION AND EMPLOYER'S LIABILITY THE PROPRIETOR/PARTNERS/EXECUTIVE OFFICERS ARE: <input checked="" type="checkbox"/> INCL <input type="checkbox"/> EXCL	N/A	X	#####	MM/DD/YYYY	MM/DD/YYYY	PER STATUTE E.L. EACH ACCIDENT \$ 500,000 E.L. DISEASE - POLICY LIMIT \$ 500,000 E.L. DISEASE - EACH EMPLOYEE \$ 500,000
or provide ND WSI Certificate (if applicable)							
#	PROFESSIONAL LIABILITY (IF APPLICABLE)	X	X	#####	MM/DD/YYYY	MM/DD/YYYY	PER CLAIM \$ 1,000,000
DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLE/SPECIAL ITEMS CONSTRUCTION ENGINEERS, INC.; , THE OWNER; , ARCHITECT; AND ALL OTHER PARTIES AS REQUIRED BY CONTRACT ARE NAMED AS ADDITIONAL NAMED INSURED ON A PRIMARY AND NONCONTRIBUTING BASIS WAIVER OF SUBROGATION IN FAVOR OF CONSTRUCTION MANAGER AND OWNER. (Please attach a copy of Additional Insured form or indicate form number). A 30-day written notice of cancellation applies. Project:							
CERTIFICATE HOLDER				CANCELLATION			
CONSTRUCTION ENGINEERS, INC. PO BOX 13378 GRAND FORKS, ND 58208-3378				SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT BUT FAILURE TO MAIL SUCH NOTICE SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE COMPANY, ITS AGENTS OR REPRESENTATIVES.			
				AUTHORIZED REPRESENTATIVE			

IMPORTANT

VIII. To accept responsibility for all damage caused by the Sub-Contractor which shall be deemed to include, without limiting the generality of the foregoing, the following: cleaning up of rubbish and debris resulting from the Sub-Contractor's work and removal of same from the Project; cleaning of walls, floors and other surfaces soiled by the Sub-Contractor; patching plaster damaged by the Sub-Contractor's work or required to be patched as an immediate part of such work; and replacing all glass broken by the Sub-Contractor; provided, however, that the Sub-Contractor shall not be responsible for any plaster damage or glass breakage existing at the time the Sub-Contractor begins work of which the Sub-Contractor notifies the Construction Manager in writing prior to commencing work hereunder. If any dispute arises between the Sub-Contractor and another sub-contractor as to which is responsible for any item of damage, the dispute shall be submitted to the Construction Manager for decision and his determination as to responsibility shall be final and binding on the Sub-Contractor.

IX. To adequately and properly protect the work to be performed by it hereunder, to be responsible for damages to persons and property occasioned by its failure so to do and to be responsible for any defective or improper work or material caused by its failure so to do, it being understood that the standards of protection shall not be less than those specified in the General Contract or required by law.

X. Not to assign or sub-let this Sub-Contract or any part thereof and not to assign any money due or to become due hereunder without first obtaining the written consent of the Construction Manager thereto.

XI. To be bound to the Construction Manager by the terms of the General Contract, to conform to and comply with the provisions of the General Contract, to furnish such shop drawings or samples as may be required, and to assume toward the Construction Manager all the obligations and responsibilities that the Construction Manager assumes in and by the General Contract toward the Owner, insofar as they are applicable to this Sub-Contract

XII. To employ no person whose employment on or in connection with this Sub-Contract may be objectionable to the Construction Manager, and to remove any such person when objected to by the Construction Manager when permissible under state law.

XIII. That the Construction Manager or his authorized representative shall have the right to order in writing the omission or addition of any parts of the work or materials as omitted from or added to the General Contract by the Architect and/or Owner; that fair deductions or increases shall be made in the contract price for such omitted or added work or materials; and that no extra work shall be allowed or changes made by the Sub-Contractor, or paid for by the Construction Manager UNLESS AND UNTIL AUTHORIZED BY THE CONSTRUCTION MANAGER OR HIS AUTHORIZED REPRESENTATIVE IN WRITING BEFORE THE WORK AND/OR CHANGES ARE BEGUN.

XIV. To obtain and furnish to the Construction Manager and maintain in effect during the life of this Sub-Contract, if requested so to do in the space provided below, a surety bond in form and with sureties acceptable to the Construction Manager and in an amount equal to the Sub-Contract price, conditioned upon and covering the faithful performance of and compliance with all the terms, provisions and conditions of this Sub-Contract, the premium therefore to be paid by the Sub-Contractor.

Bond Required

Bond Not Required

XV. To guarantee its work to the same extent that the Construction Manager is obligated to guarantee its work under the General Contract, but in any event to guarantee its work against all defects in materials or workmanship for a period of one year from the date of final acceptance of the Project by the Owner.

XVI. That in case the Sub-Contractor shall fail to correct, replace and/or re-execute faulty or defective work done and/or materials furnished under this Sub-Contract, when and as required by the Construction Manager, or shall fail to complete or diligently proceed with this Sub-Contract within the time herein provided for, or if the Construction Manager or any other sub-contractor shall be unable to proceed with the work because of any action by one or more employees of the Sub-Contractor or by a person or labor organization purporting or attempting to represent any employee of the Sub-Contractor, the Construction Manager upon three days notice to the Sub-Contractor shall have the right to correct, replace and/or re-execute such faulty or defective work, or to take over this Sub-Contract and complete same either through its own employees or through a contractor or sub-contractor of its choice, and to charge the cost thereof to the

Sub-Contractor, together with any liquidated damages caused by a delay in the performance of this Sub-Contract. For all disputes or controversies, which may arise in connection with this Contract, the Construction Manager and Sub-Contractor consent to the jurisdiction of the courts of the State of North Dakota and to the venue in Grand Forks County. The Construction Manager and the Sub-Contractor also agree that the laws of the State of North Dakota shall govern this Contract in so much as they are not preempted by Federal Law.

XVII. That in case of default on the part of the Sub-Contractor under the terms of this Sub-Contract, the material and equipment of the Sub-Contractor shall be left on the job for the use of the Construction Manager in completing the work covered by this Sub-Contract.

XVIII. To comply with all Federal and State laws, codes and regulations and all municipal ordinances and regulations effective where the work under this Sub-Contract is to be performed, and to pay all costs and expenses connected with such compliance, to pay all fees and taxes, including sales and use taxes, and also to pay all taxes imposed by any State or Federal Law for any employment insurance, pensions, old age retirement funds or any similar purpose and to furnish all necessary reports and information to the appropriate federal, state and municipal agencies with respect to all of the foregoing, the same as though the Sub-Contractor was in fact the Construction Manager, and to hold the Construction Manager, each other subcontractor and the Owner harmless from any and all loss or damage occasioned by the failure of the Sub-Contractor to comply with the terms of this paragraph.

XIX. The Construction Manager's equipment shall be available to the Sub-Contractor only at the Construction Manager's discretion and on mutually satisfactory terms.

XX. To pay all royalties and license fees; to defend all suits or claims for infringement of any patent rights involved in the work of the Sub-Contractor under this Sub-Contract: and to save the Construction Manager harmless from loss, cost or expense on account of such use or infringement by the Sub-Contractor.

XXI. If the proper performance of any item of work to be performed hereunder by the Sub-Contractor depends upon the proper performance of any item of work by the Construction Manager or another sub-contractor whose work precedes in time the work of the Sub-Contractor, to admit by commencing the item of work to be performed hereunder that the work which precedes such item of work to be done hereunder by the Sub-Contractor has been done in a proper manner.

XXII. Sub-contractors and suppliers will meet the requirements of the Occupational Safety & Health Act.

XXIII. You will be required to clean up after your work daily. If you fail to do this Construction Engineers, Inc will clean up the following day and deduct from your contract all costs incurred. Those responsible for generating debris will be responsible for hauling and disposal of it.

XXIV. Your Project Manager or Job Superintendent who is authorized to act for the company shall attend weekly progress meetings, starting one week before you are scheduled to start and ending one week after you have finished work on the site.

XXV. Construction Engineers, Inc. has a written Hazard Communications Program in compliance with OSHA 1926.59, a copy of which is in our office. You are required to adhere to the provisions of the Hazard Communication Standards. Information on hazardous chemicals, used by Construction Engineers, Inc., or known to be present, will be exchanged with you. You will be responsible for providing necessary information, (MSDS) Material Safety Data Sheets, to our office and to your employees. Our project Supervisor will hold weekly safety meetings where employees will be informed of the hazardous chemicals in accordance with our written program. If you have any questions regarding this program, contact our office.

XXVI. Construction Engineers, Inc. has adopted an Affirmative Action Policy in compliance with HUD Directive 907, Executive Order 11246 (Equal Employment Opportunity), which our company will abide by during the construction of all federal or federally assisted projects. A copy of our policy is available to you upon request.

XXVII. Construction Engineers, Inc. adopted a Drug-Free Workplace Policy in compliance with FAR clause 52.223-623.505(C), March 1989 "Drug-Free Workplace Act." A copy of our policy is also in our office.



THE CONSTRUCTION MANAGER AGREES AS FOLLOWS:

A. To employ, and does hereby employ the Sub-Contractor to do the work described in paragraph I hereof, subject to the provisions of this Sub-Contract.

B. To pay the Sub-Contractor for the full, faithful and prompt performance of this Sub-Contract, subject to all the terms and conditions hereof, the sum of [REDACTED] DOLLARS AND [REDACTED] CENTS (\$###,###.##).

C. To include in his monthly estimate to the Owner the value of all work, labor, and materials of the Sub-Contractor incorporated into the Project in accordance with the provisions of this Sub-Contract for which estimates have been furnished by the Sub-Contractor and approved by the Construction Manager, and so long as the Sub-Contractor is not in default hereunder, to pay the Sub-Contractor, promptly upon receipt thereof from the Owner, the amount received by the Construction Manager on account of the Sub-Contractor's work to the extent of the Sub-Contractor's interest therein.

Percent of retention until final payment by owner, 10 percent.

D. If arbitration of disputes is provided for in the General Contract, any disputes arising between the Construction Manager and the Sub-Contractor under this Sub-Contract shall be settled by arbitration in the manner provided for in the General Contract.

E. If notification of any claims have been made against the Sub-Contractor or the Construction Manager arising out of labor or materials furnished the Project or otherwise on account of any actions or failures to act by the Sub-Contractor in the performance of this Sub-Contract, the Construction Manager may, at his discretion, withhold such amounts otherwise due or to become due hereunder to cover said claims and any costs or expenses arising or to arise in connection therewith pending legal settlement thereof. This right of the Construction Manager shall not be exclusive of any other rights of the Construction Manager herein or by law provided.

F. The failure of the Construction Manager to make payments as and when herein provided shall, in addition to all other rights, entitle the Sub-Contractor to suspend all work and shipments during the continuance of such default on the part of the Construction Manager, and shall further entitle the Sub-Contractor to an extension of time for the performance of the work covered by this Sub-Contract for the period for which the work was so suspended.

G. This Sub-Contract constitutes the entire understanding of the parties and supersedes any prior proposals or agreements.

IN WITNESS WHEREOF, the Construction Manager and Sub-Contractor have hereunto set their hands and seals in duplicate the day and year first above written.

[REDACTED] (SEAL) Sub-Contractor

License No. _____

Valid to _____

Sales or Use Tax Permit No. _____

State of _____

By _____ signature

CONSTRUCTION ENGINEERS, INC. (SEAL) Construction Manager

License No. 34207 Class A

Valid to March 1, 20##

Sales or Use Tax Permit No. 20661100

State of North Dakota

By _____ signature NAME, TITLE

Attachment A

PROJECT SAFETY REQUIREMENTS

All subcontractors are required to comply with Construction Engineers Safety Management Plan. The safety policies and procedures are to include, but not limited to the following:

1. A copy of your company safety manual will be required along with job specific MSDS sheets **prior** to work beginning on-site. Submit via email to Construction Engineers Project Manager.
2. Subcontractors will be required to meet the safety requirements of OSHA, the Project Owner and Construction Engineers.
3. Provide a list of the on-site personnel that are certified in CPR and first aid. Submit via email to Construction Engineers Project Manager.
4. All subcontractors are required to provide their own Personal Protection Equipment (PPE). Any employees of the subcontractor that do not have the proper PPE will be asked to leave the site and allowed to return when they have the proper PPE. The minimum PPE to be provided by each subcontractor shall include:
 - A. Hardhats 100% of the time.
 - B. Safety glasses 100% of the time.
 - C. High visibility shirts/vests are required 100% of the time.
 - D. Safety toed boots as required.
 - E. Dust masks as required by the task or determined by CEI's Safety Official.
 - F. Personal fall protection equipment or appropriate systems, 100% of the time when working 6 feet above a lower level.
 - G. Hearing protection as required by the task or determined by CEI's Safety Official.
 - H. Appropriate clothing (no sleeveless shirts, tennis shoes, or shorts to be worn).
5. All subcontractors are responsible for providing the Personal Protective Equipment (PPE) required to perform their assigned scope of work safely and effectively. In the event that it is not provided by the subcontractor and CE chooses to provide this equipment, the subcontractor will fully reimburse Construction Engineers Inc. for the costs incurred with payment due upon receipt of the invoice.
6. All on-site personnel will be required to attend or conduct daily safety meetings prior to commencing work.
7. All companies on-site will be required to fill out daily Job Safety Analysis (JSA's) and turn in to Construction Engineers. If your company does not have these forms, Construction Engineers will provide a copy of this form upon request.
8. A copy of the Emergency Response Plan which indicates the emergency contacts and phone numbers will be located in the On-Site Project Manager or Superintendents trailer.
9. Each trade is required for **DAILY** clean-up of their work area. If this is not completed, Construction Engineers will conduct this clean-up the following day and deduct the costs incurred from your contract at a cost of \$ 80.00/hour plus any equipment.
10. All trades are required to provide their own tools and equipment to complete their work to include unloading of materials.
11. All personnel driving on the job-site will be required to have a valid driver's license on their person and to have safety belt worn.

12. Any personnel operating any equipment (i.e. bobcats, forklifts, etc.) shall be properly trained and certified for that particular equipment. Copies of these certificates are to be provided to Construction Engineers' Safety Official upon request.
13. It is the responsibility of the contractor to replace construction barriers/barricades that they needed to remove to complete their work.
14. When a subcontractor's employee is involved in an accident that results in personal injury or property damage, no matter how minor, the accident must be reported to Construction Engineers On-Site Project Manager or Superintendent immediately. Also to provide and complete the proper accident reporting paper work.
15. All "Near Misses" need to be reported to Construction Engineers On-Site Project Manager or Superintendent immediately.
16. Firearms, explosives, drugs and/or alcohol are not allowed on-site, anyone in possession of these items will be asked to leave the job-site.
17. Smoking will be in designated areas only; there is NO SMOKING within the building at any stage of construction. All cigarettes butts are to be placed in trash receptacles and not thrown on the ground. Violators will be asked to permanently leave the site.
18. Fighting, verbal abuse and/or argumentative posturing is not allowed on-site, both parties will be asked to leave the site.
19. The subcontractor will be required to provide additional staffing or additional hours at their cost to make up time lost as a result of their failure to follow the required safety procedures. No additional costs will be accepted for these reasons.
20. Radios will be allowed on the job site at the discretion of the On-Site Project Manager or Superintendent.
21. Vulgar or offensive language, actions and/or clothing will not be tolerated. Violators will be asked to leave the job-site.
22. At the discretion of the Construction Engineers Project Manager, weekly project coordination meetings will be held at a designated day and time, each company who is currently on-site or will be on-site within the next week are required to have a representative in attendance.

It is our intent to ensure that everyone involved in this project has a successful and safe project. Please make sure that your field staff is aware of these requirements.

I, _____, have read and understand these Project Safety Requirements and agree to submit all required documents, adhere to all safety policies and procedures stated above, and to brief the field personnel prior to sending them to the project site to begin work.

Signature

Title

Company Name

Date



200 North 69th Street
Grand Forks, ND 58203
Ph: 701-792-3200
Fax: 701-772-1808
Alt Fax: 701-780-8775
constructionengineers.com

Attachment E

Subcontractor Billing Procedures & Policies

All subcontractors are required to follow these policies and procedures to comply with the Construction Engineers (CE) Standard Subcontract Agreement and necessary payment procedures. All requests for payment shall be submitted in accordance with these policies and procedures.

1. Payment applications from subcontractors
 - a. All subcontractor applications for payment on labor, materials, or contract reimbursable funds must be submitted on an AIA G702 Application and Certificate for Payment and AIA G703 Continuation Sheet (or similar forms containing the same information). Any pay application not submitted on this form, or without any required supporting information or documentation, may in the sole opinion of CE be rejected and returned to the subcontractor for re-submittal. This may result in a delay in the processing of the pay application.
 - b. The form must include the required information, including the CE's project number, project name, and the Subcontractor's pay application number.

2. Schedule of Values
 - a. A contract Schedule of Values must be submitted to the CE Project Manager immediately upon award of subcontract and approved prior to any subcontractor applications for payment.
 - b. The agreed upon Schedule of Values shall be used and provided with all Subcontractor pay applications.
 - c. The Schedule of Values shall provide a full breakdown with scheduled amounts for each category of the work and must be presented in sufficient detail to the CE Project Manager to fully evaluate the payment application.
 - d. The Schedule of Values can only be modified for approved change orders, which shall be added as a separate line at the bottom of the approved Schedule of Values as they are approved by the CE Project Manager.

3. Billing Dates
 - a. The Subcontractor pay application, along with all of the required forms and documentation must be submitted to the CE office no later than the 25th day of the month (or as specified in the Standard Subcontract Agreement, Section III) to be processed. When this date falls on a weekend or holiday, the pay application must be submitted the following business day.
 - b. Any pay applications received after the dates outlined above or not containing all required documentation will not be processed, and may not be included in CE's pay application to the owner until the following month.
 - c. Payment applications may be mailed, faxed, or emailed to Accounting@ConstructionEngineers.com.

4. Insurance Requirements
 - a. The subcontractor shall be responsible to comply with all insurance requirements for the project as provided in the CE Standard Subcontract Agreement.
 - b. A valid and fully compliant insurance certificate shall be submitted to CE prior to commencement of any work on the project by the subcontractor and such insurance shall be maintained as further provided in the CE Standard Subcontract Agreement.
 - c. No funds requested by a payment application will be released by CE without a compliant insurance certificate in full force and effect at the time of payment.
5. Contracts
 - a. No payment applications will be processed by CE without the receipt of an executed Standard Subcontract Agreement.
6. Change Orders
 - a. A fully executed change order must be received by CE prior to or with the payment application for the subcontractor to bill for the work.
7. Stored Material Documentation
 - a. All pay applications for stored materials must be approved in advance by the CE project Manager and pay applications for off-site stored material will be allowed only if permitted by the Owner's Contract.
 - b. Billings for off-site stored materials must include the following:
 - i. Valid off-site stored material insurance certificate, policy value to meet or exceed the value of stored materials included in the pay application, with additional insured to match the project insurance requirements.
 - ii. Bill of sale executed by subcontractor or material supplier.
 - iii. Digital photographs of off-site stored material labeled for the project.
 - iv. The location of the stored materials, site contact, and inspection hours of the facility.
8. Lien Waivers
 - a. CE will send a lien waiver with each subcontractor payment. This lien waiver must be signed by the subcontractor and returned to CE. No further payments will be made until the previous signed lien waiver is received.
9. Retention Billings
 - a. All retention billings must be submitted on a separate application for payment.
 - b. Advanced approval by the CE Project Manager is required for any retention reduction billings.
 - c. All final operation and maintenance documentation, warranties, as-built drawings, and closeout documents as required by the project specifications and owner contract must be received prior to release of any retention payments.
10. Payment Timeline
 - a. Payment is made to all subcontractors in accordance with CE's Standard Subcontract Agreement.
 - b. Release of payment is subject to final approval by the CE Project Manager based on the quality and completeness of work and receipt of complete documentation.

If you have any questions relating to the policies and procedures for payment applications, please contact the CE Project Manager assigned to your project.



STANDARD CONTRACT AGREEMENT
(SPECIAL FORM FOR MATERIALS ONLY)

22##-##

Prepared by Construction Engineers, Inc.

THIS AGREEMENT, made this ##th day of MONTH, 20##, by and between CONSTRUCTION ENGINEERS, INC, PO BOX 13378, 200 NORTH 69th STREET (58203), GRAND FORKS, ND 58208-3378, hereinafter called the Construction Manager, and COMPANY NAME, ADDRESS, CITY, STATE ZIP, hereinafter called the Vendor.

WHEREAS, the Construction Manager has heretofore entered into a contract with OWNER NAME, ADDRESS, CITY, STATE ZIP, hereinafter called the Owner, to perform certain labor and furnish certain material for the erection and completion of PROJECT NAME, ADDRESS, CITY, STATE ZIP, hereinafter called the Project, pursuant to plans and specifications prepared by ARCHITECT/ENGINEER, ADDRESS, CITY, STATE ZIP, hereinafter called the Architect, which contract consisting of the following: Proposal; Contract; Specifications dated MM/DD/YY; Plans dated MM/DD/YY; General Conditions; Special Conditions; Bond (if any); Attachment(s): A - Material Supplier Billing Procedures, B - Specification Log, C - Drawing Log, D - Project Schedule; Addenda or Amendment(s): N/A; and Alternate(s): N/A to any of the foregoing, is hereinafter collectively referred to as the General Contract; and

WHEREAS, the Construction Manager has made available to the Vendor all of the above documents, except that a blank proposal form and a blank contract form have been made available in lieu of completed forms; and

WHEREAS, the above have been carefully examined by the Vendor.

THE VENDOR AGREES AS FOLLOWS:

ARTICLE I. To furnish and deliver F.O.B jobsite all the material necessary to complete the following portions of the work included in said contract between the Construction Manager and Owner in all respects, as the Construction Manager is required by said plans and specifications to do, namely:

Project Specific Inclusions:

SCOPE OF WORK

	Base Bid	\$	
	State Sales Tax (%)	\$	
	City Tax (%)	\$	
	TOTAL	\$	

ARTICLE II. That the material called for in this contract is to be furnished promptly when requested by the Construction Manager so that the work will not be delayed waiting for such material, and the Vendor agrees to complete the delivery of material covered by this contract at such times and in such manner that the Construction Manager can complete all of the work included in its contract with the Owner **as indicated on the project schedule**. If delivery is not made as herein provided, it is hereby agreed that damages arising from the non-fulfillment of this contract as regards time shall be deducted from the contract price, and be as liquidated damages and not in the nature of a penalty and shall be \$ [REDACTED] Dollars per calendar day.

The following schedule of delivery dates and shop drawing requirements shall be effective in this contract:

Schedule

- **Coordinate and complete work in accordance with the attached project schedule dated MM/DD/YY.**
- **Perform the segments of your work as directed and as specified to allow overall project substantial completion by MM/DD/YY.**

Shop Drawings / Submittals - ELECTRONIC COPIES ARE PREFERRED

- **Within 5 calendar days of receipt of this contract, submit shop drawings (1 electronic copy) to NAME@ConstructionEngineers.com and/or product data and samples and/or color charts as required by the specifications of this subcontract for all portions of work.**
- **Submit only clear, easy to read, electronic files (no scanned copies - we need files that are printed directly to a .pdf file). Please inform your manufacturers of this requirement.**
- **Submit shop drawings/product data for only materials that comply with the plans, specifications and addenda. Your company shall be held liable for products that are not compliant.**
- **Thoroughly review all submittals prior to forwarding them to Construction Engineers.**
- **NOTE: WHEN SUBMITTING PRODUCT DATA SHEETS FOR APPROVAL, YOU MUST CIRCLE (OR SOMEHOW IDENTIFY) THE APPLICABLE OPTIONS / SIZES / FEATURES THAT APPLY TO THIS PRODUCT.**

Pay Requests

- **Pay Requests are due in the CE main office (email to Accounting@ConstructionEngineers.com) by the 25th of each month. Pay Requests received after this date will be processed in the following month. No future reminders will be issued regarding the timely submission of Pay Requests.**

ARTICLE III. To pay for all materials, skill, labor and instrumentalities used in, or in connection with, the performance of this contract, when and as bills or claims therefore become due, and to save and protect the premises, the Owner, and the Construction Manager from all claims and mechanics' liens on account thereof, and to furnish satisfactory evidence to the Construction Manager when and if required, that he has complied with the above requirements. This provision shall not be construed as a waiver of the right of the Vendor to file and enforce a lien claim as against the Owner in the event of the Construction Manager's failure to pay the Vendor.

ARTICLE IV. That he has examined all the plans and read all the specifications and addenda # [REDACTED], prepared by the Architect and/or Engineer, for the entire work, of which the materials covered by this contract is a part, and that he will be bound by any and all parts of said plans and specifications and addenda insofar as they relate to the material herein undertaken to be furnished.

ARTICLE V. That the material to be furnished under this contract will be in strict accordance with the requirements of the plans and specifications and addenda, and that samples of such materials and shop drawings required will be furnished for the approval of the Architect and the Owner and that all materials furnished shall be in strict accordance with such approved samples and/or shop drawings.



ARTICLE VI. To make any and all changes, furnishing the materials that the Construction Manager may require without nullifying this agreement, at a reasonable addition to, or reduction from, the contract price, hereinafter named, NO ALTERATIONS OR CHANGES SHALL BE MADE, HOWEVER, EXCEPT UPON THE WRITTEN ORDER OF THE CONSTRUCTION MANAGER. The amount to be paid by the Construction Manager, or allowed by the Vendor, by virtue of such alterations, shall be stated in such written order.

ARTICLE VII. To comply with all Federal and State laws, codes and regulations and all municipal Ordinances and regulations effective where the work is to be performed under this contract and to pay all fees, taxes, including sales and use taxes, and expenses connected with such compliance.

The Contractor Agrees as Follows:

ARTICLE VIII. To pay the Vendor for such material herein undertaken to be furnished the sum of [REDACTED] DOLLARS AND [REDACTED] CENTS (\$###,###.##), which includes the [REDACTED] State Sales Tax ([REDACTED] %), and [REDACTED] City Tax ([REDACTED] %) subject to additions and deductions as herein before provided, and such sum shall be paid by the Contractor to the Vendor as the material is delivered in monthly installments.

ARTICLE IX. It is mutually agreed between the parties hereto, that no payment made under this contract, except the final payment, shall be conclusive evidence of the performance of this contract, either in whole or in part, and that no payment shall be construed to be an acceptance of improper materials.

IN WITNESS WHEREOF, the parties hereto have hereunto set their hands and seals the day and year first above written.

[REDACTED] (SEAL)
Vendor

CONSTRUCTION ENGINEERS, INC. (SEAL)
Construction Manager

By _____
signature

By _____
signature **NAME / TITLE**



200 North 69th Street
Grand Forks, ND 58203
Ph: 701-792-3200
Fax: 701-772-1808
Alt Fax: 701-780-8775
constructionengineers.com

Attachment A

Material Supplier Billing Procedures & Policies

All material suppliers are required to follow these policies and procedures to comply with the Construction Engineers (CE) Standard Subcontract Agreement and necessary payment procedures. All requests for payment shall be submitted in accordance with these policies and procedures.

1. Payment applications from subcontractors
 - a. All subcontractor applications for payment on labor, materials, or contract reimbursable funds must be submitted on an AIA G702 Application and Certificate for Payment and AIA G703 Continuation Sheet (or similar forms containing the same information). Any pay application not submitted on this form, or without any required supporting information or documentation, may in the sole opinion of CE be rejected and returned to the subcontractor for re-submittal. This may result in a delay in the processing of the pay application.
 - b. The form must include the required information, including the CE's project number, project name, and the Subcontractor's pay application number.
2. Schedule of Values
 - a. A contract Schedule of Values must be submitted to the CE Project Manager immediately upon award of subcontract and approved prior to any subcontractor applications for payment.
 - b. The agreed upon Schedule of Values shall be used and provided with all Subcontractor pay applications.
 - c. The Schedule of Values shall provide a full breakdown with scheduled amounts for each category of the work and must be presented in sufficient detail to the CE Project Manager to fully evaluate the payment application.
 - d. The Schedule of Values can only be modified for approved change orders, which shall be added as a separate line at the bottom of the approved Schedule of Values as they are approved by the CE Project Manager.
3. Billing Dates
 - a. The Subcontractor pay application, along with all of the required forms and documentation must be submitted to the CE office no later than the 25th day of the month (or as specified in the Standard Subcontract Agreement, Section III) to be processed. When this date falls on a weekend or holiday, the pay application must be submitted the following business day.
 - b. Any pay applications received after the dates outlined above or not containing all required documentation will not be processed, and may not be included in CE's pay application to the owner until the following month.
 - c. Payment applications may be mailed, faxed, or emailed to Accounting@ConstructionEngineers.com.

4. Contracts
 - a. No payment applications will be processed by CE without the receipt of an executed Standard Subcontract Agreement.
5. Change Orders
 - a. A fully executed change order must be received by CE prior to or with the payment application for the subcontractor to bill for the work.
6. Stored Material Documentation
 - a. All pay applications for stored materials must be approved in advance by the CE project Manager and pay applications for off-site stored material will be allowed only if permitted by the Owner's Contract.
 - b. Billings for off-site stored materials must include the following:
 - i. Valid off-site stored material insurance certificate, policy value to meet or exceed the value of stored materials included in the pay application, with additional insured to match the project insurance requirements.
 - ii. Bill of sale executed by subcontractor or material supplier.
 - iii. Digital photographs of off-site stored material labeled for the project.
 - iv. The location of the stored materials, site contact, and inspection hours of the facility.
7. Lien Waivers
 - a. CE will send a lien waiver with each subcontractor payment. This lien waiver must be signed by the subcontractor and returned to CE. No further payments will be made until the previous signed lien waiver is received.
8. Payment Timeline
 - a. Payment is made to all subcontractors in accordance with CE's Standard Subcontract Agreement.
 - b. Release of payment is subject to final approval by the CE Project Manager based on the quality and completeness of work and receipt of complete documentation.

If you have any questions relating to the policies and procedures for payment applications, please contact the CE Project Manager assigned to your project.

**SECTION 011101
CONTRACT CATEGORY SCOPE CLARIFICATIONS**

PART 1 - GENERAL

1.1 LIST OF CONTRACT FORMS

- A. Contract Category Scope Clarifications - Construction Engineers intends to award multiple trade contracts in accordance with the work scope categories issued on the following pages.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**CONTRACT CATEGORY SCOPE CLARIFICATIONS
TURTLE MOUNTAIN COMMUNICATIONS – BOTTINEAU OFFICE**



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- CC #07A – MEMBRANE ROOFING**
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- CC #09A – GYPSUM BOARD ASSEMBLIES**
- CC #09B – TILE**
- CC #09C – ACOUSTIC CEILINGS**
- CC #09D – RESILIENT FLOORING AND CARPET**
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- CC #12A – WINDOW TREATMENTS**
- CC #13A – PRE-ENGINEERED METAL BUILDING ERECTION**
- CC #22A/23A – PLUMBING AND HVAC**
- CC #26A – ELECTRICAL AND LOW VOLTAGE**
- CC #31A – EARTHWORK**
- CC #32A – ASPHALT PAVING**
- CC #32B – SITE CONCRETE**
- CC #32C – LANDSCAPING AND IRRIGATION**
- CC #32D – TEMPORARY AND PERMANENT FENCING**
- CC #33A – UTILITIES**

CONTRACT CATEGORY SCOPE CLARIFICATIONS

TURTLE MOUNTAIN COMMUNICATIONS – BOTTINEAU OFFICE



CONTRACT CATEGORY DESCRIPTION(S)

CC #00A - GENERAL REQUIREMENTS PERTAINING TO ALL CONTRACT CATEGORIES

- a. All Contractors and Suppliers are responsible for reviewing all plan documents in addition to all categories in this Scope Clarification prior to submitting their proposal.
- b. Definitions
 - i. Furnish or Supply – to source or otherwise make available a material or service.
 - ii. Install or Erect – to place or fix in place ready for use.
 - iii. Provide – to furnish or supply a material or service and install or erect.
- c. It is the intent of each Contract Category scope of work and responsibility for the Contractor bidding to provide a complete operational assembly/system, unless specifically indicated otherwise.
- d. Unless noted otherwise, all labor and material for each specification section is to be included for each Contract Category.
- e. Each Contractor is required to coordinate their work with other Contractors, as directed by the Construction Manager, without additional compensation.
- f. Each Contractor is required to manage their suppliers and subcontractors. The bidding contractor should be the single source contact for the CM for all work included in that Contract Category.
- g. All Contract Categories are tied to Specification Divisions.
 - i. 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS and
 - ii. 01 - GENERAL REQUIREMENTS
- h. All Contract Categories are tied to and shall comply with the General (G) Drawing Sheets and associated UL Assembly requirements.
- i. All Contractors are responsible for coordination and review of shop drawings (as applicable to their work) and obtaining field verifications.
- j. Field verify and inspect existing conditions and substrates to receive work prior to installation, field verify dimensions that will affect the layout or performance of your work, and confirm preparatory work is complete and acceptable to receive work under your contract category.
- k. Contractors requiring embeds or provisions for anchors cast into work by others, are responsible to provide embeds and detailed layout drawings.
- l. Each Contractor is responsible for clean-up of debris, rubbish and other similar items resulting from their operations on a daily basis.
- m. Each Contractor is responsible for their own working platforms, scaffolding, and equipment necessary to access work. The Contractor is responsible for the repair of all Contractor caused damage incurred by their crew(s) and/or subcontractor(s).
- n. All bids to be submitted on the bid form included in the specifications.
- o. It is the responsibility of the contractor doing the excavation work to call for utility locates for their scope of work.
- p. Construction Manager will provide dumpster(s) for typical construction debris accumulated under the work of this contract unless noted otherwise. Materials requiring special disposal requirements to be removed by Contractor.
- q. Construction Manager will provide temporary portable toilets.
- r. **Conflicts and Duplication in Work:** In the case of a duplication of scope responsibility either on Drawings, Specification, or Contract Category Descriptions, the Contractor is responsible to bid the work as called out regardless of potential oversight duplications.

CONTRACT CATEGORY SCOPE CLARIFICATIONS

TURTLE MOUNTAIN COMMUNICATIONS – BOTTINEAU OFFICE



- i. In the case of duplication, the Construction Manager will make the final decision as to which Contract Category will complete the work and the appropriate cost adjustment will be made.
- s. **Special Coordination and Scheduling Required:** Contractor acknowledges that the performance of their Contract Category must be closely interfaced with the performance of others and that multiple mobilizations may be required.
 - i. Maintain punctuality and compliance with agreed upon deliveries.
 - ii. Comply with Project Schedule.
 - iii. Maintain communication with Construction Manager to ensure work sequences are followed to allow all contract categories to continue work.
 - iv. Provide required “after-hours” shift work to maintain Project Schedule where indicated or required to maintain Project Schedule or to accommodate Owner’s on-going operations.
 - v. Provide any costs needed to perform work in accordance with the project schedule. No additional charges will be allowed for work being completed within the timeframe shown on the preliminary project schedule.
- t. **Document Management and Control Procedures:** Ensure on-site contractor’s personnel have current contract documents, including, but is not limited to, Special Requirements, Specifications, Drawings and clarifications (RFI’s and ASI’s) and other modifications (CCD’s and field orders) affecting the Work.
 - i. Ensure field personnel are familiar with requirements of Contract Documents.
 - ii. Contractors shall have an established document control procedure to ensure compliance.
- u. **Coordinate Layout and Clearances:** Coordinate space requirements and installation for items that are indicated diagrammatically on Documents.
 - i. Follow routing indicated for pipes, ducts and wiring, place runs parallel with line of building. In finished areas, unless expressly indicated otherwise, conceal pipes, ducts and wiring within construction. Coordinate locations of plumbing and electrical fixtures and electrical outlets with finish elements.
 - ii. Use space efficiently to maximize accessibility for other installations, maintenance and repairs.
 - iii. Installing entities shall modify their installations, if needed, to eliminate conflicts and achieve effective coordination of systems and work.
 - iv. Contractor’s failure to exercise coordination responsibilities constitutes a waiver of claims for an increase in Contract Sum if design modifications are required to resolve conflicts that might have been avoided by complying with requirements of this obligation.
- v. **Delivery and Receiving of Materials:** Provide labor and equipment necessary to receive materials, unload, inspect, sort, and distribute materials to individual work areas. Store materials and equipment in an organized manner as not to obstruct other trades and the normal day-to-day operation of this project.
 - i. All Contractors are responsible for, and costs associated with unloading, staging, and appropriate storage of their material, to include material they will be installing but supplied by others.
 - ii. Coordinate storage as allowed on site with the Construction Manager.
 - iii. Schedule deliveries to minimize on-site storage and coordinate with Construction Manager Site Supervision.
 - iv. Provide flagmen for operation in contact with public traffic for deliveries.

CONTRACT CATEGORY SCOPE CLARIFICATIONS TURTLE MOUNTAIN COMMUNICATIONS – BOTTINEAU OFFICE



- v. Construction Manager reserves the right to remove or relocate Contractor materials and/or equipment stored on site by request to the Contractor or at the expense of the Contractor if necessary.
- w. **Acceptance of Substrates and Existing Conditions:** Starting work constitutes acceptance of existing conditions, preparatory work and substrates that may affect the performance of your work.
- x. **Finish protection:** Each Contractor shall provide necessary protection of immediate and adjacent surfaces during the progression of their work.
 - i. Interior scaffolding and karts utilized on finished floors must use rubber, locking wheels.
 - ii. Contractors may not utilize finished substrates such as countertops or sills to set tools, materials, or containers of any form.
- y. **Work Restrictions:**
 - i. Contractor's Field Offices: As directed by Construction Manager.
 - ii. Construction Staging Area: As directed by Construction Manager.
 - iii. Egress and Access Routes: Do not obstruct existing access and egress from adjacent Site areas or portions of existing facilities which are to be operational during Construction.
 - iv. Limit activities to Construction Limits: Notify Construction Manager if work activities are required outside of construction limits.
 - v. Hot Work Permits: Work activities using and causing sparks and open flame must be coordinated with Construction Manager Site Supervision and special procedures shall be complied with as directed by Construction Manager.
 - vi. Working Hours: Conduct Work during normal working hours unless expressly agreed to by Construction Manager and the Owner.
 - 1. Standard five-day work week (Monday through Friday) is required. A four-day ten-hour schedule is not acceptable unless approved by the Construction Manager.
 - vii. Noise Restrictions: Do not use audio equipment such as radio's, tape players, compact disc or MP-3 players on Site.
 - 1. Radio headphones shall not be permitted.
 - 2. Maintain a level of conduct and decorum consistent with the environment in which the Work is being performed.
 - viii. Warranty: Contractor or supplier warrants that irrespective of the specification of the materials and equipment in the Plans and Specifications, the materials and equipment furnished by the applicable contractor or material supplier are appropriate for the purposes specified and are safe for the applications implicit in the Plans and Specifications.
 - ix. Additional Work: No additional compensation for claimed additional work will be authorized without advanced written authorization from the Construction Manager.

CC #01A - SURVEYING

- a. Establish benchmark for the building construction.
- b. Provide survey stakes for actual building corners with a 10' offset.
- c. Provide survey stakes for building grid lines.
- d. Provide stakes for all utility lines with 15' offsets every 25'.
- e. Provide final grading elevation stakes on a 25' grid.
- f. Provide survey stakes for all new site paving.
- g. Provide survey stakes for curb & gutter.
- h. Generally covered by specification sections as follows:
 - i. 01 4000 – Quality Requirements

CONTRACT CATEGORY SCOPE CLARIFICATIONS TURTLE MOUNTAIN COMMUNICATIONS – BOTTINEAU OFFICE



CC #01B - TESTING

- a. Soil compaction testing, proctor tests, observations.
- b. Concrete cylinders, rebar inspection.
- c. Structural steel welding observations.
- d. Generally covered by specification sections as follows:
 - i. 01 4000 – Quality Requirements

CC #03A - BUILDING CONCRETE

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Building Concrete work, including but not limited to the following:
- b. All cast-in-place concrete work including shop drawings, formwork, reinforcement (rebar and wire mesh) and accessories.
- c. All site concrete is by CC#32B.
- d. All concrete associated expansion joint materials, membranes, vapor barriers, waterproofing, and caulking/sealants.
- e. Provide and install the following items:
 - i. Foundation insulation as indicated.
 - ii. Vapor barrier under slab.
- f. Below slab insulation is by CC#22A/23A.
- g. Subgrade will be prepared, by others, within ± 2 inches, include all work from subgrade to finish floor.
- h. Finish grading of the concrete subgrade by this Contractor. Include supply and placement of sand/gravel fill to meet plan subgrade elevations.
- i. Protect and maintain foundation bearing soils in suitable condition after excavation by others.
- j. Set and install all embedded steel, anchor bolts and sleeves provided by others. Coordinate installation of sleeves with respective MEP Contractors.
- k. Set steel decking on stoops as indicated to include setting any angles that may be required. Decking and angles to be provided by the Steel Contract Category.
- l. Contractor to include all work associated hairpins.
- m. Isolation at steel columns, if any.
- n. Grout at column bases, if any.
- o. Concrete work for all pad and strip footings.
- p. Cure and seal all concrete slabs.
- q. Install bollards, bollard material provided by others.
- r. Install trench drain angle embeds.
- s. Mechanical and electrical housekeeping pads by others.
- t. Concrete Testing is by the Construction Manager. Provide assistance, if required, to the testing company.
- u. Progressive and final cleanup of the Contractor's work.
- v. Generally covered by specification sections as follows:
 - i. Division 03 - Concrete
 - ii. 07 2100 – Thermal Insulation (as applicable)
 - iii. 07 2616 – Underslab Vapor Barrier
 - iv. 07 9216 – Rigid Joint Sealants / Concrete Floor Joint Fillers (as applicable)

CONTRACT CATEGORY SCOPE CLARIFICATIONS TURTLE MOUNTAIN COMMUNICATIONS – BOTTINEAU OFFICE



CC #05A - STRUCTURAL STEEL AND METAL FABRICATION (SUPPLY)

- a. Engineer, fabricate, and deliver all structural steel framing, embedded plates, steel beam bearing plates, roof opening frames, mechanical equipment support frames and other items defined as structural steel.
- b. Engineer, fabricate, and deliver:
 - i. All shear stud connectors, deformed bar anchors, anchor rods, expansion bolts, and other incidental items of structural steel required to be built into concrete or masonry and attached to the structural frame.
 - ii. All miscellaneous steel, pipe bollards, supports, anchorage, and accessories for miscellaneous metal work.
 - iii. All steel roof deck, steel stoop deck, and related accessories.
- c. Provide shop drawings and erection drawings.
- d. Provide setting diagrams, templates, instructions, and directions for installation of anchorages, which are to be embedded in concrete or masonry.
- e. Provide engineering of all delegated connection designs indicated.
- f. Supply the following items:
 - i. All decking and angles for stoops as indicated.
 - ii. Anchor bolts for pre-engineered metal building.
- g. Shop priming of all structural steel and ferrous metal fabrications.
- h. Generally covered by specification sections as follows:
 - i. 05 1200 – Structural Steel Framing
 - ii. 05 2100 – Steel Joist Framing
 - iii. 05 3100 – Steel Decking

CC #05B - STRUCTURAL STEEL AND METAL FABRICATION (INSTALL)

- a. Provide supervision, skilled labor, and equipment necessary to install/erect all Structural Steel Framing, Steel Decking, and Metal Fabrications. Installation of items embedded in concrete or masonry are NOT included in this Contract Category.
- b. Welding must be performed by a skilled welder with a current certification for the work being performed.
- c. Owner will engage a qualified independent testing agency to inspect field welds and high-strength bolted connections in accordance with the specifications.
- d. Provide all grouting below steel bearing and base plates.
- e. Install the following items:
 - i. Miscellaneous roof deck accessories, according to deck manufacturer's written instructions, to provide a complete deck installation.
 - ii. Roof sump pans, sump plates, and reinforcing channels or zees in ribs to span between supports and weld.
- f. Touchup painting of abraded areas, welds, and rust spots on prime painted and galvanized metals.
- g. Provide temporary shoring before placing metal deck panels, if required, to meet deflection limitations and prevent overloading due to construction loads.
- h. Provide temporary railing at all roofs, mezzanines, and raised floors. Remove railing only once directed by construction manager.
- i. Include unloading of all steel deliveries.

CONTRACT CATEGORY SCOPE CLARIFICATIONS

TURTLE MOUNTAIN COMMUNICATIONS – BOTTINEAU OFFICE



- j. Pre-engineered metal building erection by CC#13A.
- k. Progressive and final cleanup of the Contractor's work. All interior areas broom cleaned.
- l. Generally covered by specification sections as follows:
 - i. 05 1200 – Structural Steel Framing
 - ii. 05 2100 – Steel Joist Framing
 - iii. 05 3100 – Steel Decking

CC #06A - ROUGH CARPENTRY

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Carpentry work, including but not limited to the following:
- b. Provide and install the following items:
 - i. Furring and rigid insulation at exterior walls.
 - ii. Wood roof blocking and sheathing.
 - iii. In-wall blocking and backing.
 - iv. Signage.
 - v. Wall and door protection.
 - vi. Toilet, bath and laundry accessories.
 - vii. Fire extinguishers and cabinets.
- c. Install the following items, supplied by others:
 - i. Casework and woodwork.
 - ii. Solid surface window sills.
 - iii. HM frames, doors, and hardware.
 - iv. All Owner furnished contractor installed (OFCl) items as indicated.
- d. Provide all fasteners required to complete all carpentry work installations.
- e. Provide, document, and communicate all field measurements for items installed by this Contract Category.
- f. Receive and offload all materials provided by others and installed by this Contract Category.
- g. Receive, offload, inventory, and store all doors, frames, and hardware.
- h. Set up temporary heaters and remove at the end of heating season.
- i. Supply pre-engineered metal building. Provide additional wall panels for use at conventionally framed building.
 - i. Full height jambs at all overhead door openings to facilitate high lift doors regardless door lift type.
 - ii. Ensure all bracing is designed for clearances needed for overhead doors and/or other wall openings, cranes, etc..
 - iii. Provide double clips where banded insulation is exposed, knife plates at areas with liner panel.
 - iv. Anchor bolts.
 - v. Roof curbs and pipe jacks. Ensure the roof curbs & jacks are compliant with roof warranty.
- j.
- k. Progressive and final cleanup of the Contractor's work.
- l. Generally covered by specification sections as follows:
 - i. Division 06 – Wood, Plastics, and Composites
 - ii. 07 4213 – Metal Wall Panels
 - iii. 08 1113 – Hollow Metal Doors and Frames
 - iv. 08 1416 – Flush Wood Doors

CONTRACT CATEGORY SCOPE CLARIFICATIONS TURTLE MOUNTAIN COMMUNICATIONS – BOTTINEAU OFFICE



- v. 08 7100 – Door Hardware
- vi. Division 10 – Specialties
- vii. 12 3600 – Countertops
- viii. 13 3419 – Metal Building Systems
- ix. 32 3110 – Signing

CC #06B - ARCHITECTURAL CASEWORK (SUPPLY)

- a. Provide all casework.
- b. Provide all countertops and vanity tops to include all build-up materials and brackets for countertops.
- c. Provide solid surface window sills.
- d. Provide templating for complex geometry situations. Basic field measurements shall be provided by others.
- e. Provide full shop drawings for all components to be provided.
- f. All woodwork provided shall be pre-finished.
- g. All materials are to include tax and freight costs for delivery to the job site.
- h. Generally covered by specification sections as follows:
 - i. 06 4100 – Architectural Wood Casework
 - ii. 12 3600 – Countertops

CC #07A – MEMBRANE ROOFING

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Roofing work, including but not limited to the following:
- b. Provide and install the following:
 - i. EPDM Roofing.
 - ii. Tapered roof insulation.
 - iii. Protection board.
 - iv. Manufactured roof cants.
 - v. Pre-finished metal flashing.
 - vi. Counter flashing.
 - vii. Overflow scuppers.
 - viii. Roof expansion joint assemblies.
- c. Install all roof curbs and boots provided by others.
- d. Provide manufacturer's warranty.
- e. Special attention is called to the Mechanical, Electrical, and Structural drawings. Note penetrations that may not be on the Architectural Roof Drawings.
- f. Progressive and final cleanup of the Contractor's work.
- g. Generally covered by specification sections as follows:
 - i. 07 5323 – EPDM Thermoset Single-Ply Roofing
 - ii. 07 6200 – Sheet Metal Flashing and Trim
 - iii. 07 7100 – Roof Specialties
 - iv. 07 7200 – Roof Accessories

CC #07B - JOINT SEALANTS / FIRESTOPPING

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- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Caulking and Firestopping work, including but not limited to the following:
- b. Aluminum windows to exterior veneer and interior drywall.
- c. Casework, countertops, and window sills.
- d. Acoustical sealants by CC#09A.
- e. Firestopping from wall assembly to metal deck at all rated assemblies.
- f. Hollow metal frames to wall assemblies – both sides.
- g. Progressive and final cleanup of the Contractor's work.
- h. Generally covered by specification sections as follows:
 - i. 07 9216 – Rigid Joint Sealants / Concrete Floor Joint Fillers

CC #07C - CEMENT BOARD SIDING

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Cement Board Siding work, including but not limited to the following:
- b. Provide full shop drawings of systems and samples for approval.
- c. Provide field measurements.
- d. Provide and install the following items:
 - i. Concealed faster system for complete cement board siding system.
 - ii. Concealed caulking and counter flashing of all installed components.
 - iii. Caulking required at cement board siding, including to dissimilar materials.
 - iv. Provide voluntary alternate to provide Zee furring and insulation at all conventionally framed exterior walls.
- e. Provide all clips and fasteners required to install panels.
- f. Progressive and final cleanup of the Contractor's work.
- g. Generally covered by specification sections as follows:
 - i. 07 4646 – Fiber-Cement Siding
 - ii. 07 6200 – Sheet Metal Flashing and Trim

CC #07D - FLUID-APPLIED AIR BARRIER

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Fluid-Applied Air Barrier work, including but not limited to the following:
- b. Minimum 4' x 4' mock-up sample of work to be completed containing all building components that will be in contact with air barrier.
- c. Provide product that is capable of being applied at the average temperature when the work will be required.
- d. Wrap all wall openings with self-adhesive membrane.
- e. Progressive and final cleanup of the Contractor's work.
- f. Generally covered by specification sections as follows:
 - i. 07 2726 – Fluid-Applied Membrane Air Barrier

CC #07E - SPRAY FOAM INSULATION

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Spray Foam Insulation work, including but not limited to the following:
- b. Provide and install the following:

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- i. Spray foam insulation.
 - 1. Any insulation that is not concealed with gypsum board must be coated with intumescent paint by this contractor.
- c. Progressive and final cleanup of the Contractor's work.
- d. Generally covered by specification sections as follows:
 - i. 07 2119 – Foamed-In-Place Insulation

CC #08A - DOORS AND HARDWARE (SUPPLY)

- a. Furnish all hollow metal frames, hollow metal doors, wood doors, and finish hardware.
- b. Provide complete shop drawing for all frames, doors, and hardware provided.
- c. All doors and frames to be factory machined, ready for installation, including trim kits and cutouts for openings.
- d. Provide a keying schedule that incorporates the Owner's existing keying schedule.
- e. Supply cylinders for aluminum entrance doors.
- f. All wood doors shall be supplied pre-finished.
- g. Hollow metal frames to include two spreader bars.
- h. Verify the stop locations for glass thickness with the Architect.
- i. Furnish a commercial key cabinet acceptable to the Construction Manager.
- j. Furnish silencers at all door frames.
- k. Furnish all fasteners for the glazing stops in sidelights, transom lights, borrowed lights, and door glazing kits.
- l. All materials are to include tax and freight costs for delivery to job site.
- m. Generally covered by specification sections as follows:
 - i. 08 1113 – Hollow Metal Doors and Frames
 - ii. 08 1416 – Flush Wood Doors
 - iii. 08 7100 – Door Hardware

CC #08B - OVERHEAD SECTIONAL DOORS

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Overhead Sectional Doors, including but not limited to the following:
- b. Provide field measurements.
- c. Provide full shop drawings for all components to be provided.
- d. Coordinate with Electrical Contractor for any power requirements.
- e. Progressive and final cleanup of the Contractor's work.
- f. Generally covered by specification sections as follows:
 - i. 08 3613 – Sectional Doors

CC #08C - ALUMINUM STOREFRONT, GLASS AND GLAZING

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Aluminum Storefront, Glass, and Glazing work, including but not limited to the following:
- b. Provide all interior aluminum storefront and glazing.
- c. Provide door hardware for openings provided under this Contract Category. Cylinders to be provided and installed by others.

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- d. Provide and install the following items:
 - i. Sill flashing.
 - ii. Glazing kits in doors.
 - iii. Glass and glazing in hollow metal frames.
 - iv. Power assist door operators.
 - v. Interior and exterior caulking of all assemblies.
- e. Provide semi-rigid and/or spray foam insulation at storefront assemblies for a complete system as per manufacturer recommendations.
- f. Field measure all openings.
- g. Progressive and final cleanup of the Contractor's work.
- h. Generally covered by specification sections as follows:
 - i. 07 9216 – Rigid Joint Sealants / Concrete Floor Joint Fillers
 - ii. 08 4313 – Aluminum Framed Storefronts
 - iii. 08 5113 – Aluminum Windows
 - iv. 08 5659 – Service and Teller Window Units
 - v. 08 7100 – Door Hardware
 - vi. 08 7113 – Power Door Operators
 - vii. 08 8000 – Glazing

CC #09A - GYPSUM BOARD ASSEMBLIES

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Structural Metal Stud Framing and Gypsum Board Assemblies work, including but not limited to the following:
- b. Engineering of all structural framed metal stud walls. Provide design calculations to Construction Manager for review.
- c. Provide any welding of studs if required by Metal Stud Engineer.
- d. Installation of all hollow metal frames in metal stud walls, frames provided by others.
- e. Provide and install all the following items:
 - i. Structural and non-structural metal stud framing.
 - ii. All hat channel, sealants, ceiling suspension system assemblies, and/or metal furring required.
 - iii. Soffit framing.
 - iv. All building insulation and acoustical insulation at metal stud assemblies.
 - v. Acoustical sealants.
 - vi. All interior, exterior, abuse resistant, and moisture resistant sheetrock as scheduled.
 - vii. Cement board (Durock) at walls to receive tile.
 - viii. Install access panels provided by others.
 - ix. All exterior gypsum sheathing.
 - x. All taping and fire taping.
 - xi. Joint sealants as applicable to work scope.
 - xii. All fasteners required for the installation of work in this Contract Category.
- f. Return drywall to windows in gypsum assemblies.
- g. Provide control joints.
- h. Finish walls to level required by plans and specifications.
- i. Provide for offloading and stocking of all materials provided under this Contract Category.
- j. Progressive and final cleanup of Contractor's work.

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- k. Generally covered by specification sections as follows:
 - i. 05 4000 – Cold Formed Metal Framing
 - ii. 07 2100 – Thermal Insulation
 - iii. 07 9216 – Rigid Joint Sealants / Concrete Floor Joint Fillers
 - iv. 09 2116 – Gypsum Board Assemblies
 - v. 09 2216 – Non-Structural Metal Framing

CC #09B - TILE

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Tile work, including but not limited to the following:
- b. Provide floor preparation as necessary.
- c. Grouting of tile – use epoxy grout where scheduled.
- d. Provide crack isolation and/or waterproofing membranes, if required.
- e. Provide all accessories, including thresholds and transition strips.
- f. Provide special detailing around floor drains to ensure desired results.
- g. All sealants associated with tile work and sealants from tile to dissimilar materials.
- h. Provide extra materials as noted.
- i. Progressive and final cleanup of Contractor's work.
- j. Generally covered by specification sections as follows:
 - i. 09 3000 – Tiling

CC #09C - ACOUSTIC CEILINGS

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Acoustic Ceiling work, including but not limited to the following:
- b. Provide ACT, grid assemblies, and suspension materials.
- c. Special attention is called to the Mechanical and Electrical drawings. Note ceiling devices that may not be on the reflected ceiling plans.
- d. Provide washable and moisture resistant tiles if noted.
- e. Provide joint sealants as applicable to work scope.
- f. Provide extra materials as noted.
- g. Progressive and final cleanup of Contractor's work.
- h. Generally covered by specification sections as follows:
 - i. 07 9216 – Rigid Joint Sealants / Concrete Floor Joint Fillers
 - ii. 09 5100 – Acoustical Ceilings
 - iii. 09 5426 – Suspended Wood Ceilings

CC #09D - RESILIENT FLOORING AND CARPET

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Resilient Flooring, Carpet, and Resilient Base work, including but not limited to the following:
- b. Provide all materials required to install flooring and base items as indicated in the room finish schedule.

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- c. Immediately upon award, communicate any requirements from flooring suppliers regarding the use of cures and/or any other floor preparation that may negatively affect the product and/or ability to provide warranty of the material.
- d. Include all transitions between dissimilar flooring materials.
- e. Minor floor prep shall be provided.
- f. Provide extra materials as noted.
- g. Testing of floors to ensure compatibility with adhesives and proper moisture content.
- h. Progressive and final cleanup of Contractor's work.
- i. Generally covered by specification sections as follows:
 - i. 09 6500 – Resilient Flooring
 - ii. 09 6813 – Tile Carpeting

CC #09E - PAINTING

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Painting work, including but not limited to the following:
- b. Paint all interior & exterior exposed steel structures and lintels as noted on the drawings. Clean and prep prior to painting.
- c. Paint main frames and frame braces at the pre-engineered metal building. Wall girts and roof purlins will be covered by liner panel and not required to receive paint.
- d. All components in the ceiling of rooms scheduled for exposed painted ceilings shall be painted, including all mechanical and electrical components.
- e. Paint walls, soffits, and ceilings as indicated on the Room Finish Schedule.
- f. Wood doors to be factory finished by others.
- g. Provide sealing of concrete in rooms scheduled for sealed concrete finish.
- h. Application of finish paint to any surface will indicate this Contractor's acceptance of the surface as being properly prepared for finish paint. Exceptions will be made for damage caused by other trades after final paint coat has been applied.
- i. Prior to painting, provide protection to adjacent surfaces of dissimilar finishes.
- j. Progressive and final cleanup of the Contractor's work.
- k. Generally covered by specification sections as follows:
 - i. 09 9113 – Exterior Painting
 - ii. 09 9123 – Interior Painting

CC #12A - WINDOW TREATMENTS

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Window Treatment work, including but not limited to the following:
- b. Provide field measurements.
- c. Multiple mobilizations to job site.
- d. Provide all components necessary to provide a complete functional system.
- e. Assure that shade breaks line up with window mullions as best as possible. Shade breaks at glazing shall not be permitted unless approved in advance.
- f. Progressive and final cleanup of the Contractor's work.
- g. Generally covered by specification sections as follows:
 - i. 12 2400 – Window Shades

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CC #13A - PRE-ENGINEERED METAL BUILDING ERECTION

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Pre-Engineered Metal Building Erection work, including but not limited to the following:
- b. Engineered shop drawings stamped by engineer licensed in the state of North Dakota.
- c. Unload all building materials.
- d. Structural frames and secondary structure to include all required fasteners, clips, and all other components required to provide a full structural system.
- e. Metal wall panels and all associated trims. All walls shall have eave and rake closures, and gasketed fasteners to provide a sealed wall condition.
- f. Metal wall panels on conventionally framed building. Structure, furring, and insulation will be provided by others.
- g. Standing seam clips, panels, gutters, downspouts, snowguards, and trims. Provide minimum UL 90 uplift.
- h. Liner panel and trims. Include trims at all panel perimeters, including at framed openings, floor, frame column and rafter, and wall to ceiling joints.
- i. Roof and wall expansion joints, wall to ceiling trims, and any other trims required to connect to other buildings.
- j. Roof and wall insulation, liner, and banding.
- k. Roof seamer rental.
- l. Install PEMB supplied and prepped windows.
- m. Regardless of specifications a single source warranty is required. Installation crews must satisfy the requirements for a single source warranty as outlined by MBCI's Weathertightness Warranty guidelines.
- n. All work to be completed per the manufacture's details to achieve the Weathertightness Warranty. Any deficiencies found during the inspections should be corrected within 15 days of receipt of the report. Any additional materials or equipment required to correct the deficiencies and the cost of the required trips/inspections will be the responsibility of the contractor.
- o. The contractor shall include in their pay application schedule of values a line item indicated as Roof Warranty that will total 5% of the erection cost. This line items will be paid out upon receipt of the Weathertightness Warranty.
- p. Progressive and final cleanup of the Contractor's work.
- q. The following items are excluded from this Contract Category:
 - i. Structural framing and misc. metals provided by Structural Steel Supplier.
 - ii. Pre-engineered metal building supply.
 - iii. Walk doors, overhead doors, louvers.
- r. Generally covered by specification sections as follows:
 - i. 07 4213 – Metal Wall Panels
 - ii. 07 6200 – Sheet Metal Flashing and Trim
 - iii. 07 9216 – Rigid Joint Sealants / Concrete Floor Joint Fillers
 - iv. 13 3419 – Metal Building Systems

CC #22A/23A - PLUMBING AND HVAC

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Mechanical and Plumbing work, including but not limited to the following:

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- b. Provide fire caulking/firestopping of all penetrations through fire rated assemblies.
- c. Provide joint sealants as applicable to scope of work.
- d. Provide all required permits to complete the work of this Contract Category.
- e. Provide required testing, such as pressure and disinfection testing of newly installed water services.
- f. Provide piping from interior of building to utility connections 5 feet outside of building.
- g. Provide flange at water service for fire suppression system connection.
- h. Provide all core drilling required for the work of this Contract Category.
- i. Assist with set up and take down of temporary heating equipment.
- j. Provide all controls and control wiring for mechanical equipment.
- k. Provide all mechanical louvers, factory finished.
- l. Provide all piping and duct insulation.
- m. Provide all rigid insulation and piping for the radiant floor heat.
- n. Provide all hoisting equipment needed to set all rooftop equipment after erection of all steel and installation of roofing.
- o. Provide all mechanical pads required for equipment in this Contract Category.
- p. Provide all concrete mechanical curbs required.
- q. Supply and layout all roof curbs and boots to be installed by roofing contractor.
- r. Provide Owner training in use of new equipment.
- s. Provide all gas piping from the meter inside the building.
- t. Provide piping and connection to irrigation system.
- u. Ductwork in room(s) with painted, exposed ceilings shall be provided ready to receive paint.
- v. Provide rain leaders as construction progresses to limit water within incomplete building.
- w. Provide all access doors and panels required for access to equipment & valves related to this Contract Category.
- x. Provide all water/glycol for the mechanical system.
- y. Provide finish sealants at all fixtures.
- z. Assure conformance with specified ceiling heights and allow room for access to equipment requiring access for maintenance. Coordinate in advance if any conflicts exist or if any deviations are required.
- aa. Coordinate and provide start-up, testing & balancing, and adjustment of system to meet manufacturer and specified requirements prior to completion.
- bb. Provide temporary accommodations to run air handlers during construction for finishes or provide temporary climate control with utilization of temporary equipment.
- cc. Progressive and final cleanup of the Contractor's work.
- dd. Generally covered by specification sections as follows:
 - i. 07 9216 – Rigid Joint Sealants / Concrete Floor Joint Fillers
 - ii. Division 22
 - iii. Division 23

CC #26A - ELECTRICAL AND LOW VOLTAGE

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Electrical work, including but not limited to the following:
- b. Provide fire caulking/firestopping of all penetrations through fire rated assemblies.
- c. Provide joint sealants as applicable to scope of work.
- d. Provide all required permits to complete the work of this Contract Category.
- e. Provide temporary lighting.

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- f. Provide all trenching for site electrical.
- g. Provide all electrical pads required for equipment in this Contract Category.
- h. Coordinate installation of new electrical service with local utility company. Any costs associated with getting new service into the building but not directly billed to the Owner shall be provided by this Contract Category.
- i. Provide all core drilling required for the work of this Contract Category.
- j. Provide wiring to irrigation control system.
- k. Owner will supply all data wiring. Rough-in and pulling wire by contractor, termination and testing by Owner.
- l. Provide all fire alarm components noted.
- m. Provide materials and services required as noted in lighting plan.
- n. Provide all concrete curbs required.
- o. All controls and control wiring for mechanical equipment are by others.
- p. Provide Owner training in use of new equipment.
- q. Assist with set up and take down of temporary heating equipment.
- r. Provide all access doors and panels required for access to equipment & valves related to this Contract Category.
- s. Provide all trenching, excavation, backfill and compaction for interior and exterior conduits required in this Contract Category.
- t. Provide core drilling for all underground electrical through foundations as necessary.
- u. Coordinate and provide start-up, testing, and adjustment of system to meet manufacturer and specified requirements prior to completion.
- v. Furnish, install, and remove temporary electrical power at locations necessary to be used by other multiple trades to complete their scope of work.
- w. Furnish, install, and remove temporary lighting throughout the building. Light shall be adequate to allow other trades to complete their work.
- x. Assure compliance to the overall schedule provided to allow required completion of activities associated with this Contract Category. Assure necessary overtime hours and manpower is provided to meet the requirement of the overall schedule. Provide dedicated crews and manpower when multiple simultaneous tasks must take place under this Contract Category.
- y. Provide labeling at all receptacles to match breakers and also indicate emergency power and/or GFCI protection.
- z. Coordinate system disturbances/outages with Construction Manager and Owner.
- aa. Progressive and final cleanup of the Contractor's work.
- bb. Generally covered by specification sections as follows:
 - i. 07 9216 – Rigid Joint Sealants / Concrete Floor Joint Fillers
 - ii. Divisions 26 & 27

CC #31A - EARTHWORK

- a. Provide supervision, layout, shop drawings, labor, material, equipment and other incidental items of cost to complete all Sitework, including but not limited to the following:
- b. Erosion control, soil stabilization, slope protection and their maintenance until final stabilization and acceptance by the Construction Manager. This package includes all work required to abide by the requirements of the Storm Water Pollution Prevention Plan (SWPPP) associated with only this Project and approved by the State of North Dakota. The Construction Manager will be responsible

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- for acquiring the SWPPP Permit. Any fines levied due to lack of erosion control and maintenance will be the responsibility of this Contractor.
- c. Construction of temporary roads, parking areas, and lay down areas as indicated on the Staging Plan. Maintenance of all temporary roads and hardstand areas, including grading, dust control, and snow removal. At project completion and as directed by the Construction Manager, remove all temporary hardstand surfaces and return areas to original condition.
 - d. Temporary grassing to all disturbed areas and its maintenance until acceptance by the Construction Manager.
 - e. Contractor shall be responsible for coordinating with all utility companies for the location of buried utilities prior to excavation whether shown on the plans or not shown, as necessary to accommodate proposed construction.
 - f. Provide and arrange barricades and signage to accommodate site work and facilitate traffic control as required to perform this scope of work.
 - g. Contractor shall maintain vehicle and pedestrian access to private and public areas at all times.
 - h. Provide daily street cleaning during construction periods in which earthwork activities occur.
 - i. Provide and pay for all temporary utilities necessary for the scope of work within this Contract Category.
 - j. Contractor shall maintain the pavement section with construction methods that will maintain the integrity of the subgrade during subsequent pavement placement operations within ± 1 inch.
 - k. Site preparation and site clearing as indicated.
 - l. Restore all areas to preconstruction conditions or better.
 - m. Import approved topsoil, bedding and structural fill materials as necessary.
 - n. Unsuitable soils shall be removed underneath all foundation concrete and replaced with structural fill materials, over excavate as needed.
 - o. Excavate, haul off site, and lawfully dispose of all unsuitable soils that will not be reused on the Project Site.
 - p. All sitework grading.
 - q. Structural excavation, backfill, and compaction for all building foundations, concrete slab-on-grade, and site concrete.
 - r. Provide any geotextile fabric required beneath the aggregate base.
 - s. Dewatering of site and excavations.
 - t. All work shall be in accordance with the Geotechnical Report prepared by Material Testing Services dated October 24, 2024.
 - u. Progressive and final cleanup of the Contractor's work.
 - v. Generally covered by specification sections as follows:
 - i. 01 5713 – Erosion Control
 - ii. 02 4100 – Site Demolition
 - iii. Divisions 31
 - iv. 32 1123 – Aggregate Base Courses

CC #32A - ASPHALT PAVING

- a. Provide supervision, layout, shop drawings, labor, material, equipment, and other incidental items of cost to complete all Asphalt Paving work, including but not limited to the following:
- b. All asphalt paving including parking lots and driveways.
- c. Provide pavement striping.
- d. Provide sealants at paved areas.

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- e. Include mobilizations to complete paving in two separate lifts so base course lift can be utilized temporarily for construction parking/laydown.
- f. Progressive and final cleanup of the Contractor's work.
- g. Generally covered by specification sections as follows:
 - i. 32 1216 – Asphalt Paving

CC #32B - SITE CONCRETE

- a. Provide supervision, layout, shop drawings, labor, material, equipment, and other incidental items of cost to complete all Site Concrete work, including but not limited to the following:
- b. All site concrete work including concrete walks, valley gutter, walkways, ramps, and pads with forming, reinforcement, and accessories.
 - i. Provide propane tank pad.
 - ii. Provide transformer pad.
- c. Provide fine grading of base materials installed by others.
- d. Provide keyways as indicated.
- e. Provide all reinforcing and dowels.
- f. Provide all detectable inserts/surfaces in concrete pavement.
- g. Provide all saw cutting of concrete in patterns indicated.
- h. Provide all sealants at control joints included in this Contract Category.
- i. Provide any tooling patterns in concrete shown.
- j. Price alternate for providing concrete pavement in lieu of asphalt pavement in parking areas. Include striping as indicated on plans.
- k. Concrete testing is by the Construction Manager. Provide assistance if required, to the testing company.
- l. Progressive and final cleanup of the Contractor's work.
- m. Generally covered by specification sections as follows:
 - i. 32 1313 – Concrete Paving

CC #32C - LANDSCAPING AND IRRIGATION

- a. Provide supervision, layout, shop drawings, labor, material, equipment, and other incidental items of cost to complete all Seeding and Landscaping work, including but not limited to the following:
- b. Provide delegated design for mulch and plantings based on general layout shown on A001. Provide preliminary design drawings with completed bid form.
- c. Provide decorative stone rip-rap at locations indicated.
- d. Repair areas damaged by construction by seeding.
- e. Maintain seeded/sodded areas after planting for the duration indicated in specifications.
- f. Progressive and final cleanup of the Contractor's work.
- g. Generally covered by specification sections as follows:
 - i. 32 9219 – Seeding

CC #32D – TEMPORARY AND PERMANENT FENCING

- a. Provide temporary fencing as indicated on the drawings and specifications.
- b. Provide gate(s) as indicated. Each gate is to be a minimum of 16'-0" wide.
- c. Temporary driven posts spacing to be a maximum of 15'-0" on center.

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- d. Provide diagonal post bracing at all corners.
- e. Removal of all temporary fencing and gates at the completion of the project.
- f. Progressive and final cleanup of the Contractor's work.
- g. Generally covered by specification sections as follows:
 - i. 32 3113 – Chain Link Fences and Gates

CC #33A - UTILITIES

- a. Contractor shall be responsible for coordinating with all utility companies for the location of buried utilities prior to excavation whether shown on the plans or not shown, as necessary to accommodate proposed construction.
- b. Include removal/replacing inverts and core drilling holes in existing manholes.
- c. Contractor to include all exterior sanitary sewer, water main, and storm water work within 5 feet of the building and according to the Utility Plan. Include all trenching, backfill, and compaction. Contractor must coordinate elevations with Plumbing contractor.
- d. Contractor to include gate valves, tapping tees and any other components required to make connections to existing piping.
- e. Provide all bedding materials for utility piping.
- f. Tie into existing structures as noted.
- g. Contractor to include exploratory work as necessary to confirm invert elevations.
- h. Provide barricades and signage, and arrange to close streets as required to complete the contracted work.
- i. Provide daily street cleaning during construction periods in which utility activities occur.
- j. Provide and pay for all temporary utilities necessary for the scope of work within this Contract Category.
- k. Provide required testing, such as pressure and disinfection testing, of newly installed water services.
- l. Provide cleaning of utilities if required.
- m. Includes restoration of disturbed areas, to include compaction of trenches, re-spreading of topsoil, and seeding of grass to previous condition.
- n. Progressive and final cleanup of the Contractor's work.
- o. Generally covered by specification sections as follows:
 - i. Division 33

**SECTION 012300
ALTERNATES**

GENERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. **Alternate No. 1:** Provide a price for changing 6" Asphalt areas on sheet C500 to 6" reinforced concrete pavement as shown on Sheet C600.
 - 1. Base Bid: 6" Asphalt as shown on Sheet C500.

- B. **Alternate No. 2:** Provide a price for changing adding (5) Type C windows to West Elevation of Garage as shown on Sheet A201 (Elevation 3). Window Type C as shown on detail 9 on Sheet A601.
 - 1. Base Bid: No windows on West Elevation.

PART 4 - GENERAL

4.1 RELATED DOCUMENTS

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

4.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

4.3 DEFINITIONS

- A. **Alternate:** An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

4.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 5 - PRODUCTS (Not Used)

PART 6 - EXECUTION

6.1 SCHEDULE OF ALTERNATES

A. **Alternate No. AA: Add Payment and Performance Bond**

- 1. If required by Construction Engineers, the cost to provide a Labor and Material Payment Bond and Performance Bond in the amount equal to one hundred percent (100%) of the subcontract price for the Base Bid above.

B. **Alternate No. 1A: Event Venue Lighting and Rigging**

- 1. Base Bid: Event Venue Lighting
 - a. Base bid includes power feeds to ALL relay panels, dimmer rack, and auxiliary power Company Switch disconnect panels. Only the relay panels are base bid, the dimmer rack and Company Switches are added by alternate.
 - b. Base bid includes the relay panels and all related branch power circuits and receptacle boxes.
 - c. Base bid includes all lighting control data distribution for architectural lighting and production lighting.
 - d. Base bid includes all architectural lighting fixtures in the auditorium, all work lighting on stage and in the catwalks and control rooms.
 - e. Base bid includes a modest number of production lighting fixtures for the stage area, refer to Section 26 09 61 for fixture types and quantities.
 - f. Base bid includes the complete architectural lighting control system including button stations and LCD touch screens. No lighting control console is included in the base bid system.
- 2. Base Bid: Event Venue Rigging
 - a. Base bid includes a 480V power disconnect switch for stage rigging winches.

- b. Base bid includes (2) motorized winch linesets to support the LED video wall, and all related winch controls. Winch power feeds and control wiring by Division 26.
 - c. Base bid includes dead hung (fixed) battens for over-stage lighting and curtains.
 - d. Base bid includes a modest number of curtains and related curtain tracks.
 - e. Base bid includes the rigging lock rail only to protect the edge of the rigging pit. No other counterweight rigging equipment is included in the base bid.
3. Alternate: Event Venue Lighting
- a. Alternate provides dimmer rack and auxiliary power Company Switch disconnects.
 - b. Alternate provides branch circuits from the dimmer rack.
 - c. Alternate provides additional production lighting fixtures, fixture accessories, and follow spots for the stage area, refer to Section 26 09 61.
 - d. Alternate provides lighting control console and console accessories.
4. Alternate: Event Venue Rigging
- a. Alternate provides all counterweight rigging linesets.
 - b. Alternate provides additional curtains and curtain tracks.

END OF SECTION

**SECTION 012900
PAYMENT PROCEDURES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All information regarding subcontractor payment procedures is included in the example Form of Agreement between Construction Manager and Subcontractor provided in Section 00 7310.1 – Attachment C – Subcontractor Billing Procedures & Policies.

- B. All information regarding material supplier payment procedures is included in the example Form of Agreement between Construction Manager and Material Supplier provided in Section 00 7310.2 – Attachment A – Material Supplier Billing Procedures & Policies.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

**SECTION 013500
PROPOSED CONSTRUCTION SCHEDULE**

PART 1 - GENERAL

1.1 CONSTRUCTION SCHEDULE

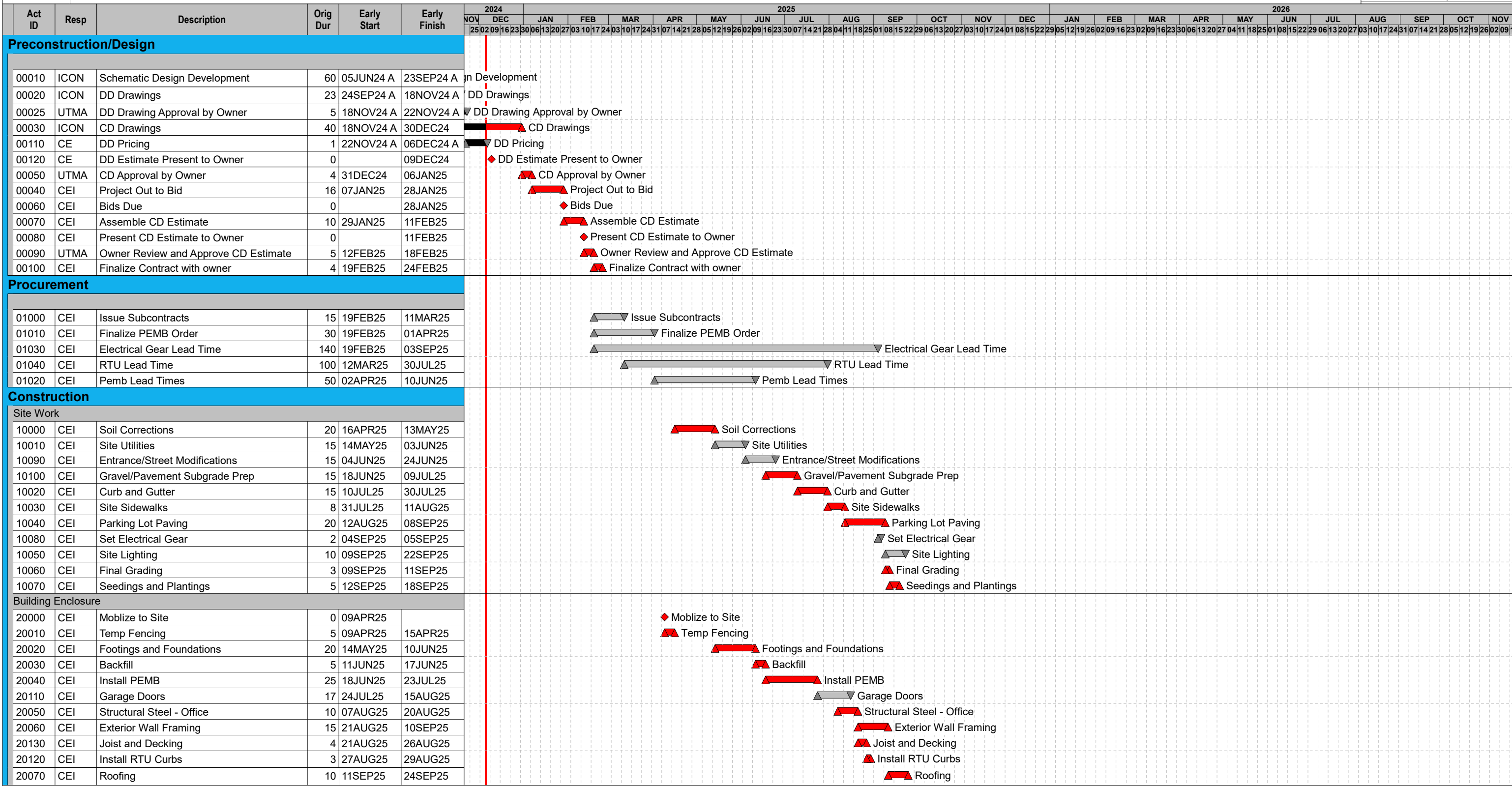
- A. Contractors shall include in their bid the necessary means to meet the timelines proposed on the current schedule issued on the following pages.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

UTMA BOTTINEAU - OVERALL SCHEDULE - DD UPDATE



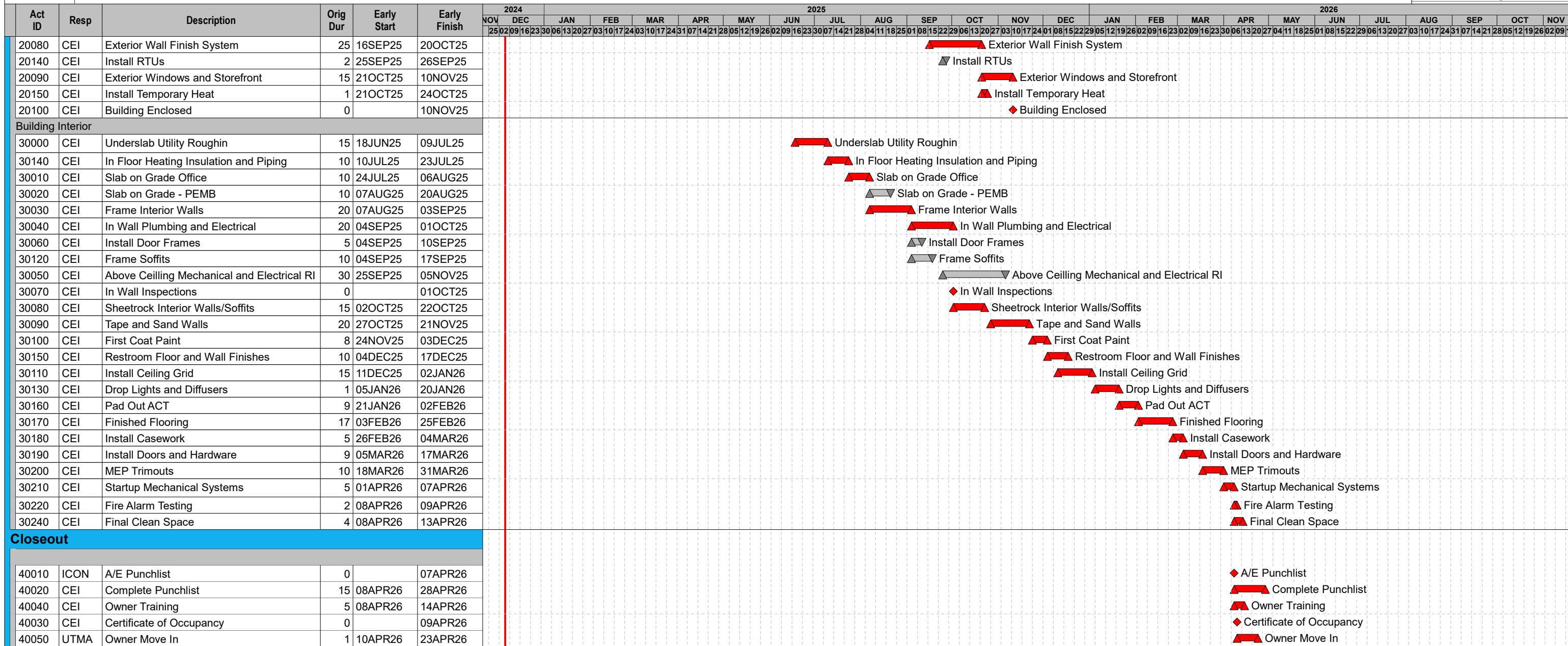
▲ Early start point	█ Critical bar	▼ Summary point
▽ Early finish point	— Summary bar	◆ Start milestone point
▬ Early bar	▲ Progress point	◆ Finish milestone point
█ Progress bar	▲ Critical point	

Company name	Construction Engineers
Start date	05JUN24
Data date	06DEC24
Run date	06DEC24
Finish date	28APR26
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Date	Revision	Checked	Approved
06DEC24	DD Update	CD	CD
20SEP24	Preliminary	CD	CD



UTMA BOTTINEAU - OVERALL SCHEDULE - DD UPDATE



▲ Early start point	█ Critical bar	▼ Summary point
▽ Early finish point	— Summary bar	◆ Start milestone point
█ Early bar	▲ Progress point	◆ Finish milestone point
█ Progress bar	▲ Critical point	

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Date	Revision	Checked	Approved
06DEC24	DD Update	CD	CD
20SEP24	Preliminary	CD	CD

**SECTION 014000
QUALITY REQUIREMENTS**

PART 3 EXECUTION

1.01 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.

1.02 DEFECT ASSESSMENT

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

END OF SECTION

**SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Division 01 Section "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Division 31 Section "Dewatering" for disposal of ground water at Project site.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: No existing water system is available for use. Provide outsourced water as required for construction operations.
- C. Electric Power Service from Existing System: No existing system is available for use. Provide temporary connections and extensions of services as required for construction operation

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion and Sedimentation Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent
- C. Fire Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.5 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Construction Manager shall engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8 inch OD line posts and 2-7/8 inch OD corner and pull posts. Provide galvanized-steel bases for supporting posts.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- C. Dust-Control Adhesive-Surface Walk-off Mats: CM to provide mats minimum 36 by 60 inches, if required.
- D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Construction Manager's Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Furnished and equipped office as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no less than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
 - 3. Drinking water

4. Coffee machine and supplies.
 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- B. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
1. Install at locations approved by Construction Manager
 2. Due to space limitations, not all subcontractors will be allowed to have field offices on site. Approval is at Construction Manager's discretion.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
1. Install at locations approved by Construction Manager
 2. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Construction Manager will provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Construction Manager to provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Connect to temporary electric power service.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

2. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 2. Maintain support facilities until Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
 1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: see site logistics plan found in 01 5000.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Construction Manager to provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Construction Manager to provide waste disposal dumpsters for all trades.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Division 01 Section "Summary."
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2017 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 31 Section "Site Clearing."
- D. Storm water Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rains.
- E. Site Enclosure Fence: Before construction operations begin, Construction Manager shall furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Construction Manager shall maintain security by limiting number of keys and restricting distribution to authorized personnel.
- F. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- J. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 4. Insulate partitions to control noise transmission to occupied areas.
 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 6. Protect air-handling equipment.
 7. Provide walk-off mats at each entrance through temporary partition.
- K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01

Section "Closeout Procedures."

END OF SECTION



UNITED AND TURTLE MOUNTAIN COMMUNICATIONS BOTTINEAU, NORTH DAKOTA

STRUCTURAL

ICON ARCHITECTURAL GROUP
222 EAST MAIN STREET, SUITE B
MANDAN, ND 58554
(701) 751.0430 OFFICE

MECHANICAL

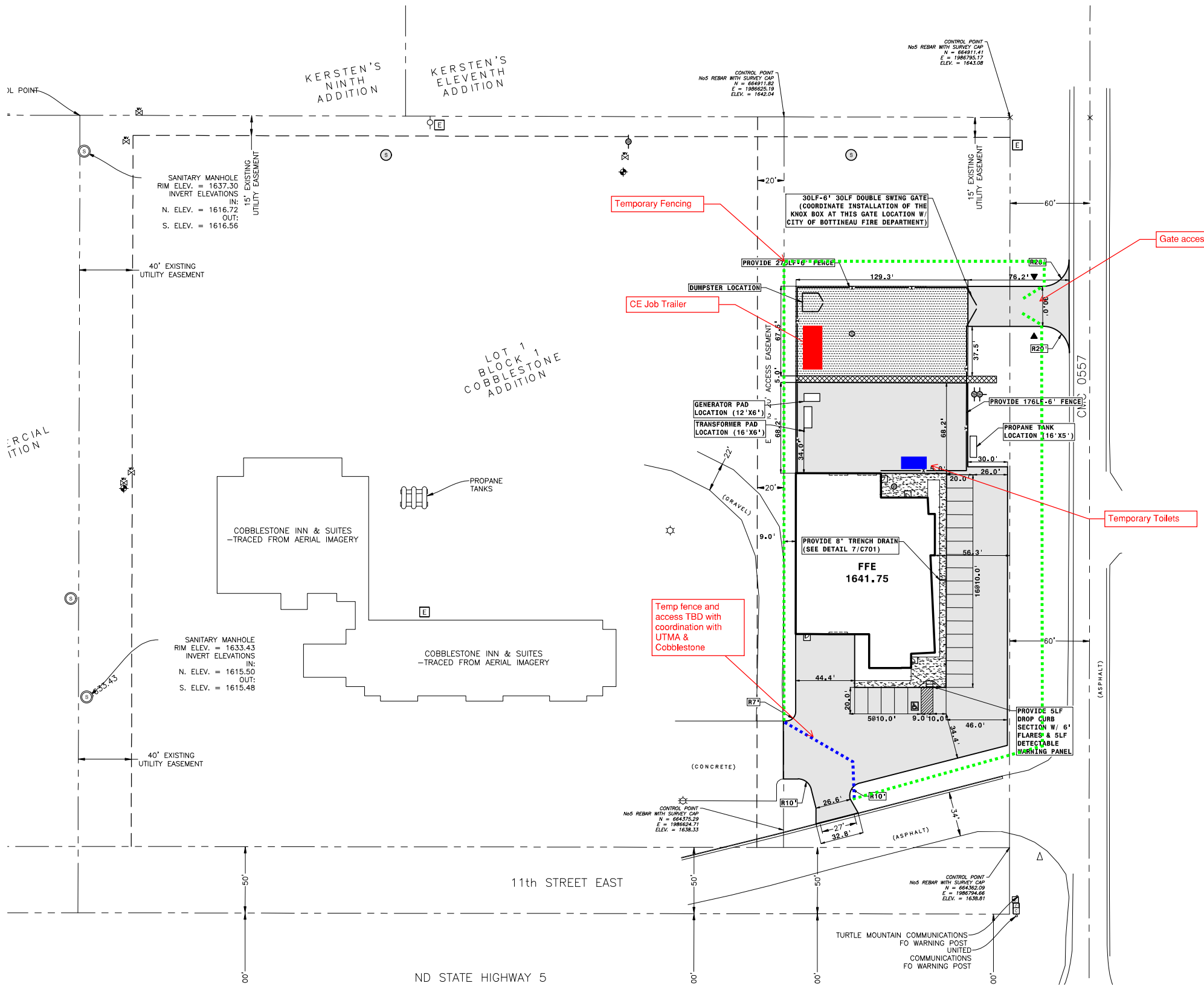
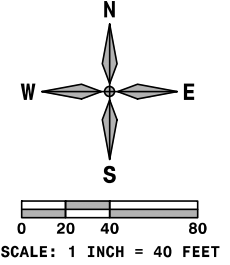
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ELECTRICAL

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CIVIL

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SYMBOL LEGEND:

	EXISTING PROPERTY LINE
	EXISTING EASEMENT LINE
	EXISTING STORM SEWER CULVERT
	EXISTING SANITARY SEWER LINE
	EXISTING WATER LINE
	EXISTING ELECTRICAL LINE
	EXISTING COMMUNICATIONS LINE
	EXISTING FLARED END SECTION
	EXISTING SANITARY SEWER MANHOLE
	EXISTING HYDRANT
	EXISTING WATER GATE VALVE
	EXISTING LIGHT POLE
	EXISTING POWER POLE
	EXISTING ELECTRICAL PEDESTAL
	EXISTING COMMUNICATIONS PEDESTAL
	NEW FLARED END SECTION
	NEW SANITARY MANHOLE
	NEW SANITARY CLEANOUT
	NEW FIRE HYDRANT
	NEW GATE VALVE
	NEW CURB STOP
	NEW FENCE LINE
	NEW THICKENED EDGE CONCRETE SIDEWALK
	NEW 6" ASPHALT PAVEMENT (BASE BID)
	NEW 12" GRAVEL AREA
	NEW VALLEY GUTTER
	PROPOSED UTILITY EASEMENT

PLAN NOTES:

- ALL WORK SHALL COMPLY WITH THE MOST RECENT CITY OF BOTTINEAU STANDARD SPECIFICATIONS FOR CONSTRUCTION OF PUBLIC UTILITIES.
- CONTRACTOR SHALL NOTIFY UTILITY COMPANIES FOR UNDERGROUND LOCATIONS 48 HOURS PRIOR TO BEGINNING CONSTRUCTION. NORTH DAKOTA ONE CALL PHONE NUMBER: 1-800-795-0555
- CONTRACTOR SHALL PROTECT ALL PROPERTY PINS. PROPERTY PINS DESTROYED OR DISTURBED SHALL BE REPLACED AT CONTRACTORS EXPENSE.
- CONTRACTOR SHALL MAINTAIN TEMPORARY EROSION CONTROL UNTIL PERMANENT EROSION CONTROL IS ESTABLISHED.
- CONTRACTOR SHALL ACQUIRE AN EROSION SEDIMENT CONTROL (ESC) PERMIT FROM THE CITY OF BOTTINEAU PRIOR TO START OF CONSTRUCTION.
- IF THE LAND BOUNDARY DENOTED ON THE PLANS ENCOMPASSES ONE (1) ACRE OR MORE, A GENERAL PERMIT FOR THE AUTHORIZATION TO DISCHARGE STORM WATER ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM/STATE DISPOSAL SYSTEM (NPDES/SDS) PERMIT SHALL BE ACQUIRED BY THE CONTRACTOR AND OWNER FROM MINNESOTA POLLUTION CONTROL AGENCY (MPCA) A MINIMUM OF SEVEN (7) DAYS PRIOR TO CONSTRUCTION.
- ALL PAVEMENT MARKED FOR DEMOLITION SHALL BE FULL DEPTH SAW CUT PRIOR TO REMOVAL.
- ALL GRASSED AREAS DISTURBED BY CONSTRUCTION SHALL BE TOPSOILED (6" DEPTH), GRADED, SEEDED, AND HYDRO-MULCHED.
- EXCAVATION OR OTHER WORK IN THE RIGHT-OF-WAY SHALL REQUIRE A TRAFFIC CONTROL PLAN THAT MEETS ALL MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) REQUIREMENTS. THIS PLAN IS REQUIRED BEFORE ANY PERMITS TO WORK IN THE RIGHT-OF-WAY WILL BE ISSUED.

SITE INFORMATION:

ADDRESS:	1109 11TH STREET E, BOTTINEAU, ND
LEGAL DESCRIPTION:	PARCEL A OF LOT 1 OF BLOCK 1 OF COBBLESTONE ADDITION TO THE CITY OF BOTTINEAU
LOT SIZE:	2.14 ACRE (39404 SF)
ZONING:	B-2 (CENTRAL BUSINESS)
SETBACKS:	NONE (SECTION 6, 6.0409.4)
EXISTING IMPERVIOUS:	7636 SF
EXISTING PERVIOUS:	31768 SF

NOT FOR CONSTRUCTION

DRAWING HISTORY		
NO.	DESCRIPTION	DATE
1	DESIGN DEVELOPMENT	11/18/2024

DRAWN BY: BRC JN: 24-054

PAVING PLAN

SHEET
C500

SECTION 015713
EROSION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractors.

1.02 RELATED REQUIREMENTS

- A. Section 312200 - Site Grading: Temporary and permanent grade changes for erosion control.
- B. Section 312323 - Fill and Backfill.
- C. Section 321123 - Aggregate Base Courses: Temporary and permanent roadways.

1.03 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.
- B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.; 1999a (Reapproved 2014).
- C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015 (Reapproved 2023).
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
- E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2012.
- F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017 (Reapproved 2021).
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; 1995.
- I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2009.

1.04 PERMITTING REQUIREMENTS

- A. Construction General Permit (CGP)
 - 1. The Construction General Permit authorizes the discharge of storm water associated with construction activity and small construction activity as defined under the National Pollutant Discharge Elimination System (NPDES)/ State Disposal System (SDS) program.
 - a. Construction activity includes clearing, grading, excavation, that disturbs land of equal to or greater than five (5) acres and includes the disturbance of less than five (5) acres of total land area that is a part of a larger common plan of development or sale if the larger common plan will ultimately disturb five (5) acres or more.

- b. Small construction activity includes clearing, grading, excavation, that disturbs land of equal to or greater than one (1) acre, and includes the disturbance of less than one (1) acre of total land area that is part of a larger common plan of development or sale if the larger common plan will ultimately disturb equal to or greater than one and less than five (5) acres. Small construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the facility.
 - 2. To obtain coverage under the general permit, the General Contractor must submit the following:
 - a. Notice of Intent (NOI).
 - b. Storm Water Pollution Prevention Plan (SWPPP).
- B. Notice of Intent (NOI)
 - 1. The Construction Manager shall complete the NOI form for construction activity.
 - a. NOI form can be found at:
https://deq.nd.gov/wq/2_ndpdes_permits/7_stormwater/stw.aspx
 - b. All Contractors are responsible for the day to day supervision of construction activities and are responsible for compliance with the permit conditions.
 - 2. The NOI shall contain, at a minimum, the following information:
 - a. Owner name, mailing address and phone number.
 - b. Project contact name and phone number.
 - c. Project/Site name.
 - d. Project/Site location (street address; section; township; range; or latitude and longitude; county.
 - e. Brief description of the construction activity.
 - f. The anticipated start date and the anticipated completion date for the project.
 - g. The estimated total area of the site and the total are of disturbance in acres.
 - h. Name of receiving waters or the name of the municipal storm sewer system and receiving waters.
 - i. The signature of the applicant/owner.
- C. Storm Water Pollution Prevention Plan (SWPPP)
 - 1. The Construction Manager shall complete the SWPPP and must be available for review by the ND Health Department at the time of application. The SWPPP must be completed prior to the start of construction.
 - a. The SWPPP form can be found at:
https://deq.nd.gov/wq/2_ndpdes_permits/7_stormwater/stw.aspx

1.05 TERMINATION OF COVERAGE

- A. Notice of Termination (NOT)
 - 1. Contractor(s) wishing to terminate coverage under the CGP must submit a Notice of Termination (NOT) to the ND Department of Environmental Quality.
 - 2. Contractor(s) must submit a NOT within 30 days after one or more of the following conditions have been met:
 - a. Final Stabilization has been achieved on all portions of the site for which the contractor is responsible.
 - b. Another Owner/Contractor has assumed control over all areas of the site that have not been finally stabilized.

1.06 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.
- B. Best Management Practices Standard: FHWA FLP-94-005.

- C. Runoff Calculation Standard for Urban Areas: USDA TR-55.
- D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
 - 1. Contractor will obtain permits and pay for securities required by authority having jurisdiction.
 - 2. Owner will withhold payment to equivalent to all fines resulting from non-compliance with applicable regulations.
- E. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- F. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 10 years.
- G. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- H. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- I. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- J. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- K. Open Water: Prevent standing water that could become stagnant.
- L. Maintenance: Maintain temporary preventive measures until permanent measures have been established.
- M. Coordination: All Contractors are responsible for coordinating work and environmental impacts with the General Contractor. Concerns must be addressed and incorporated into the SWPPP prior to construction. The General Contractor is responsible for

upholding and managing the SWPPP.

- N. Fines: Fines incurred due to non-compliance by contractors shall be levied to the responsible contractor.

1.07 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- C. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.
- D. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- B. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 - 1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
 - 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D4491.
 - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
 - 4. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
 - 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
 - 6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
 - 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
 - 8. Manufacturers:
 - a. BP Amoco, Amoco Fabrics and Fibers : www.geotextile.com.
 - b. TenCate: www.tencate.com/#sle.
 - c. Propex Geosynthetics: www.geotextile.com/#sle.
- C. Silt Fence Posts: One of the following, minimum 5 feet long:
 - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
 - 2. Softwood, 4 by 4 inches in cross section.
 - 3. Hardwood, 2 by 2 inches in cross section.
- D. Gravel: See Section 321123 for aggregate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. Erosion Prevention Practices:
 - 1. General Contractor must plan for and implement appropriate construction phasing, vegetative buffer strips, horizontal slope grading and other construction practices that minimize erosion, so that the inspection and maintenance requirements are complied with.
 - 2. All exposed soil areas with a continuous positive slope within 200 lineal feet of a surface water, must have temporary erosion protection or permanent cover for the exposed soil areas year round. This includes constructed storm water management pond side slopes and any exposed soil areas with a positive slope to a storm water conveyance system, such as a curb and gutter system, storm sewer inlet, temporary or permanent drainage ditch or other natural or man made systems that discharge to a surface water. See the guidelines below:
 - a. Slopes steeper than 3:1: Establish temporary or permanent cover within 7 days.
 - b. Slopes 10:1 to 3:1: Establish temporary or permanent cover within 14 days.
 - c. Flatter than 10:1: Establish temporary or permanent cover within 21 days.
 - 3. The normal wetted perimeter of any temporary or permanent drainage ditch that drains water from a construction site, or diverts water around a site, must be stabilized within 200 lineal feet from the property edge, or from the point of discharge to any surface water. Stabilization must be completed within 24 hours of connecting to a surface water.
 - 4. Pipe outlets must be provided with temporary or permanent energy dissipation within 24 hours of connection to a surface water.
- B. Sediment Control Practices
 - 1. Sediment control practices must minimize sediment from entering surface waters, including curb and gutter systems and storm sewer inlets.
 - a. Temporary or permanent drainage ditches and sediment basins that are designed as part of a treatment system require sediment control practices only as appropriate for site conditions.
 - b. If the down gradient treatment system is overloaded, additional up gradient sediment control practices must be installed to eliminate the overloading, and the SWPPP must be amended to identify these additional practices.
 - c. In order to maintain sheet flow and minimize rill and/or gullies, there shall be no unbroken slope length of greater than 75 feet for slopes with a grade of 3:1 or steeper.
 - 2. Sediment control practices must be established on all down gradient perimeters before any up gradient land disturbing activities begin. These practices shall remain in place until final stabilization has been established.
 - a. Linear Sediment Barriers: Made of silt fences.
 - 1) Provide linear sediment barriers:
 - (a) Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - (b) Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
 - (c) Along the toe of cut slopes and fill slopes.

- (d) Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
 - (e) Across the entrances to culverts that receive runoff from disturbed areas.
 - 2) Space sediment barriers with the following maximum slope length upslope from barrier:
 - (a) Slope of Less Than 2 Percent: 100 feet.
 - (b) Slope Between 2 and 5 Percent: 75 feet.
 - (c) Slope Between 5 and 10 Percent: 50 feet.
 - (d) Slope Between 10 and 20 Percent: 25 feet.
 - (e) Slope Over 20 Percent: 15 feet.
 - 3. The timing of the installation of sediment control practices may be adjusted to accommodate short-term activities such as clearing or grubbing, or passage of vehicles. Any short-term activity must be completed as quickly as possible and the sediment control practices must be installed immediately after the activity is completed. However, sediment control practices must be installed before the next precipitation event even if the activity is not complete.
 - 4. All storm drain inlets must be protected by appropriate BMP's during construction until all sources with potential for discharging to the inlet have been stabilized.
 - 5. Temporary soil stockpiles must have silt fence or other effective sediment controls, and cannot be placed in surface waters, including storm water conveyances such as curb and gutter systems, or conduits and ditches.
 - 6. Vehicle tracking of sediment from the construction site must be minimized by BMP's such as rock construction pads, concrete or steel wash racks, or equivalent systems. Street sweeping must be used if such BMP's are not adequate to prevent sediment from being tracked onto the street.
 - a. Construction Entrances: Traffic-bearing aggregate surface.
 - 1) Width: 30 feet, minimum.
 - 2) Length: 50 feet, minimum.
 - 3) Provide at each construction entrance from public right-of-way.
 - 4) Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
 - 7. The General Contractor must install all temporary sedimentation basins if outlined in the plan documents.
- C. Dewatering and Basin Draining
- 1. Dewatering or basin draining (e.g., pumped discharges, trench/ditch cuts for drainage) related to the construction activity that may have turbid or sediment laden discharge water must be discharged to a temporary or permanent sedimentation basin on the project site whenever possible. If the water cannot be discharged to a sedimentation basin prior to entering the surface water, it must be treated with the appropriate BMP's, such that the discharge does not adversely affect the receiving water or downstream landowners. The General Contractor must ensure that discharge points are adequately protected from erosion and scour. The discharge must be dispersed over natural rock riprap, sand bags, plastic sheeting or other accepted energy dissipation measures. Adequate sedimentation control measures are required for discharge water that contains suspended solids.
 - 2. All water from dewatering or basin draining activities must be discharged in a manner that does not cause nuisance conditions, erosion in receiving channels or on downslope properties, or inundations in wetlands causing significant adverse impact to the wetland.
 - 3. The level of the water table can be high and often fluctuates seasonally. The Contractor shall take this fact into account when preparing his bid. **All dewatering**

is considered incidental to the the Project.

4. If the Contractor intends to dewater any construction area and discharge that water to a drain or stream, they must first obtain coverage under North Dakota's General Permit to discharge from temporary dewatering activities. To obtain coverage under this permit or for additional information, contact the North Dakota Department of Health, Environmental Health - Water Quality section at 701-328-5210. Any costs associated with the permit shall be paid for by the Contractor.
 5. While pond excavation takes place, the general contractor shall be responsible for providing all pumps and necessary BMP's to complete the excavation of the pond. Once the pond has been excavated to the plan elevations and rough graded, the pumping responsibilities will be transferred to the City of Horace and their contractor. Prior to transfer of pumping responsibilities, the Engineer for the West Fargo School District and the City of Horace shall inspect and approve.
- D. Pollution Prevention Management Measures
1. Contractors shall implement the following pollution prevention management measures on the site:
 - a. Solid Waste: Collected sediment, asphalt and concrete millings, floating debris, paper, plastic, fabric, construction and demolition debris and other wastes must be disposed of properly and must comply with governing state regulations.
 - b. Hazardous Materials: Oil, gasoline, paint and any hazardous substances must be properly stored, including secondary containment, to prevent spills, leaks or other discharge. Restricted access to storage areas must be provided to prevent vandalism. Storage and disposal of hazardous waste must be in compliance with governing state health department regulations.
 - c. External washing of trucks and other construction vehicles must be limited to a defined area of the site. Runoff must be contained and waste properly disposed of. No engine degreasing is allowed on site.
- E. Final Stabilization
1. The General Contractor is responsible for final stabilization of the site.
 2. The Construction Manager must submit a Notice of Termination within 30 days after final stabilization has been completed, or another Contractor has assumed control over all areas of the site that have not undergone final stabilization.
 3. Final Stabilization can be accomplished once the following items have been completed:
 - a. All soil disturbing activities at the site have been completed and all soils have been stabilized by a uniform perennial vegetative cover with a density of 70 percent over the entire pervious surface area, or other equivalent means necessary to prevent soil failure under erosive conditions have been established.
 - b. All drainage ditches, constructed to drain water from the site after construction is complete, must be stabilized to preclude erosion.
 - c. All temporary synthetic, and structural erosion prevention and sediment control BMP's must be removed.
 - d. The General Contractor must clean out all sediment from conveyances and from temporary sedimentation basins that are to be used as permanent water quality management basins.
 - e. Sediment must be stabilized to prevent it from being washed back into the basin, conveyances or drainageways discharging off-site or to surface waters. The cleanout of permanent basins must be sufficient to return the basin to design capacity.

3.04 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
1. Excavate minimum of 6 inches.

2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
 3. Place and compact at least 6 inches of 1 1/2 to 3 1/2 inch diameter stone.
- B. Silt Fences:
1. Store and handle fabric in accordance with ASTM D4873/D4873M.
 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
 5. Install with top of fabric at nominal height and embedment as specified.
 6. Embed bottom of fabric in a trench on the upslope side of fence, with 2 inches of fabric laid flat on bottom of trench facing upslope; backfill trench and compact.
 7. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
 8. Fasten fabric to wood posts using one of the following:
 - a. Four nails per post with 3/4 inch diameter flat or button head, 1 inch long, and 14 gage, 0.083 inch shank diameter.
 - b. Five staples per post with at least 17 gage, 0.0453 inch wire, 3/4 inch crown width and 1/2 inch long legs.
 9. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
 10. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.
- C. Mulching Over Large Areas:
1. Dry Straw and Hay: Apply 2-1/2 tons per acre; anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
- D. Temporary Seeding and Hydro-Mulching for stockpile locations:
1. When hydraulic seeder is used, seedbed preparation is not required.
 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
 3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft.
 4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft.
 5. Incorporate fertilizer into soil before seeding.
 6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch deep.
 7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
 8. Repeat irrigation as required until grass is established.
 9. Install hydro-mulch for erosion protection. Apply mulch slurry at a rate of [45] lbs per 1000 sq ft evenly in two intersecting directions. The mulch shall have a tacking and bonding agent to ensure lasting stabilization and reduce erosion potential. The tackifier shall be installed per manufacturer's recommendations.

3.05 INSPECTIONS & MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. All inspections and maintenance conducted during construction must be recorded in writing and these records must be retained with the SWPPP. Records of each inspection and maintenance activity shall include:
 - 1. Date and time of inspection.
 - 2. Name of person(s) conducting inspections.
 - 3. Finding of inspections, including recommendations for corrective actions.
 - 4. Corrective actions taken (including dates, times, and party completing maintenance activities).
 - 5. Date and amount of rainfall events greater than 1/2 inch (0.5 inches) in 24 hours.
 - 6. Documentation of changes made to the SWPPP.
- C. All erosion prevention and sediment control Best Management Practices (BMP's) must be inspected to ensure integrity and effectiveness. All non functional BMP's must be repaired, replaced, or supplemented with functional BMP's. The General Contractor must investigate and comply with the following inspection and maintenance requirements:
 - 1. Silt Fences:
 - a. Promptly replace fabric that deteriorates unless need for fence has passed.
 - b. Remove silt deposits that exceed one-third of the height of the fence.
 - c. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
 - 2. Surface Waters:
 - a. Surface waters, including drainage ditches and conveyance systems, must be inspected for evidence of sediment being deposited by erosion.
 - b. The General Contractor must remove all deltas and sediment deposited in surface waters, including drainage ways, catch basins and other drainage systems and restabilize the areas where sediment removal results in exposed soil. Removal and stabilization must take place within seven (7) days of discovery unless precluded by legal, regulatory, or physical access constraints.
 - c. The General Contractor shall use all reasonable efforts to obtain access. If precluded, removal and stabilization must take place within seven (7) calendar days of obtaining access.
 - d. The General Contractor is responsible for contacting all local, regional, state and federal authorities and receiving any applicable permits, prior to conducting any work.
 - 3. Construction Exit Locations:
 - a. Construction site vehicle exits must be inspected for evidence of off-site sediment migration onto paved surfaces.
 - b. Tracked sediment must be removed from all off-site paved surfaces within 24 hours of discovery.
 - 4. Temporary and Permanent Best Management Practices (BMP's):
 - a. The General Contractor is responsible for the operation and maintenance of all permanent water quality management BMP's, as well as all erosion prevention and sediment control BMP's, for the duration of the project; or until another Contractor has resumed control over all areas of the site that have not been finally stabilized; or the site has undergone final stabilization.
 - 5. Migrated Sediment Off-Site:
 - a. If sediment escapes the construction site, off-site accumulations of sediment must be removed in a manner and at a frequency sufficient to minimize off-

site impacts.

- D. Clean out temporary sediment control structures weekly and relocate soil on site.
- E. Place sediment in appropriate locations on site; do not remove from site.

3.06 RECORD RETENTION

- A. The SWPPP, including all certificates, reports, and records must be made available to the federal, state and local officials within 72 hours upon request for the duration of the permit and for three (3) years following the Notice of Termination.

END OF SECTION

**SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.

PART 2 PRODUCTS

2.01 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

3.01 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.

3.02 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.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. 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.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.04 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. 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.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
 - D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
 - E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
 - F. Restore work with new products in accordance with requirements of Contract Documents.
 - G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
 - H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.
 - I. 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.

3.05 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.

3.06 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.

3.07 ADJUSTING

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

3.08 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. 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.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.09 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- 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 Owner-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.

3.10 MAINTENANCE

END OF SECTION

**SECTION 017900
DEMONSTRATION AND TRAINING**

PART 1 GENERAL

1.01 SUMMARY

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
 - 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. Make commissioning submittals on time schedule specified by Commissioning Authority.
 - 4. 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.

1.03 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
SITE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.

1.02 RELATED REQUIREMENTS

- A. Section 015713 - Erosion Control.
- B. Section 312200 - Site Grading: Topsoil removal.
- C. Section 312323 - Fill and Backfill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 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; 2013.

1.04 PROJECT CONDITIONS

- A. 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.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: As specified in Section 312323 - Fill and Backfill

PART 3 EXECUTION

3.01 SCOPE

- A. Remove all items as indicated on plans.
- B. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

3.02 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 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 Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
- E. 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.
- F. 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.
- G. If hazardous materials are discovered during removal operations, stop work and notify Owner's Representative and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- H. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

3.03 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 the Owner and the local governing authority.
- 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 Utility Companies.
- 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.

3.04 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 033000
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete foundation walls.
- D. Concrete foundations and anchor bolts for pre-engineered building.
- E. Concrete reinforcement.
- F. Joint devices associated with concrete work.
- G. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.
- H. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 033511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.
- B. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.
- D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- E. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- F. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- G. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
- H. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- I. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- J. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
- N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.
- O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.
- P. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.
- Q. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

- R. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- S. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
- T. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2023.
- U. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
- V. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
- W. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).
- X. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.
- Y. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.
- Z. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.
- AA. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- BB. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.
- CC. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- DD. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.
- EE. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.
- FF. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.
- GG. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018 (Reapproved 2023).
- HH. ASTM D2103 - Standard Specification for Polyethylene Film; 2023a.
- II. ASTM D8139 - Standard Specification for Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction; 2023.
- JJ. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
- KK. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).
- LL. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

2. For membrane-forming, moisture emission-reducing, curing and sealing compound, provide manufacturer's installation instructions,.
- C. Mix Design: Submit proposed concrete mix design.
 1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
 2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.
 3. Indicate proposed mix design complies with admixture manufacturer's written recommendations.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Test Reports: Submit report for each test or series of tests specified.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
- B. Follow recommendations of ACI PRC-305 when concreting during hot weather.
- C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI PRC-347 to provide formwork that will produce concrete complying with tolerances of ACI SPEC-117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
 2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
 3. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches (38 mm) of concrete surface.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 1. Type: Deformed billet-steel bars.
 2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
 1. Form: Flat Sheets.
- C. Reinforcement Accessories:
 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- G. Accelerating Admixture: ASTM C494/C494M Type C.
- H. Retarding Admixture: ASTM C494/C494M Type B.
- I. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder:
 - 1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.
 - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107/C1107M.
 - 2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:
 - a. Maximum: Plus 4 percent.
 - b. Minimum: Plus 1 percent.
 - 3. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
 - 4. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch (48 MPa).
 - 5. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).
 - 6. Products containing aluminum powder are not permitted.

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
 - 1. Complying with ASTM C881/C881M and of Type required for specific application.
- C. Slab Isolation Joint Filler: 1/2-inch (13 mm) thick, height equal to slab thickness, with removable top section forming 1/2-inch (13 mm) deep sealant pocket after removal.
 - 1. Material: ASTM D1751, cellulose fiber.
 - 2. Material: ASTM D1752, sponge rubber (Type I).
 - 3. Material: ASTM D8139, semi-rigid, closed-cell polypropylene foam.
 - 4. Material: Closed-cell, non-absorbent, compressible polymer foam in sheet form.

2.07 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- C. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.
 - 1. Comply with ASTM C309 standards for water retention.
 - 2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 14-day water cure when tested in accordance with ASTM C39/C39M.

3. VOC Content: Zero.
- D. Resin Curing Compound: Solvent-based liquid, white pigmented, membrane-forming.
 1. For use on exterior slabs. When slab will be painted, sealed, topped, or receive other applied finish, completely remove curing compound after curing is complete and before finish coatings are applied.
 2. Comply with ASTM C309, Type 2, Classes A and B.
- E. Moisture-Retaining Sheet: ASTM C171.
 1. Curing paper, regular.
 2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch (0.102 mm).
 3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard (1.71 kg/sq m).
- F. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch (0.102 mm) thick, clear.
- G. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.
 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 4. Water-Cement Ratio: Maximum 40 percent by weight.
 5. Total Air Content: Indicated on drawings percent, determined in accordance with ASTM C173/C173M.
 6. Maximum Slump: 4 inches (100 mm).
 7. Maximum Aggregate Size: 3/4 inch (19 mm).

2.09 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.
- C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

- D. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R, _____.
- E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- F. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- G. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI PRC-304.
- B. Place concrete for floor slabs in accordance with ACI PRC-302.1.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Ensure reinforcement, inserts, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
 - 1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
 - 2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
 - 3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.

- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch (6 mm) or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch (6 mm) or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
- D. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:
 - 1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI PRC-302.1; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
 - 2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 - 3. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.
 - 4. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Surfaces Not in Contact with Forms:
 - 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
 - 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - 3. Final Curing: Begin after initial curing but before surface is dry.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards (76 cu m) or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

**SECTION 03 35 00
CONCRETE FINISHING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Application of clear, colorless, liquid concrete hardener and densifier (at all exposed interior concrete slabs).
- C. Application of water-based concrete enhancer (at all exposed interior concrete slabs).

1.02 RELATED SECTIONS

- A. Section 03 00 00 - Cast-in-Place Concrete.

1.03 REFERENCES

- A. ASTM C779 - Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
- B. ASTM F609 - Standard Test Method for Using a Horizontal Pull Slip Meter (HPS).

1.04 SUBMITTALS

- A. Comply with Section 01 33 00 - Submittal Procedures.
- B. Submit manufacturer's product data and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in a clean, dry area in accordance with manufacturer's instructions.
- C. Keep products from freezing.
- D. Avoid direct contact with this product, as it may cause mild-to-moderate irritation of the eyes and/or skin.
- E. Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply concrete densifier and chemical hardener when concrete temperature is below 40° F (4° C) or above 135° F (57° C).
- B. Do not apply to frozen concrete.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Basis of Design: W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.
- B. Substitutions: Requests for substitutions will be considered in accordance with the provisions of Section 01 2500 Substitution Procedures.

2.02 MATERIALS

- A. Performance-Based Specification:
 - 1. Concrete densifier and chemical hardener compound shall be a ready-to-use, water-based, colorless liquid formulated with chemically reactive raw materials that meets the maximum VOC content limits of 100 g/L for sealers as required by the South Coast Air Quality Management District requirements, as well as the 400 g/L VOC maximum required by the U.S. EPA Architectural Coatings Rule.
 - 2. Concrete enhancer shall be a ready-to-use, water-based, synthetic polymer concrete floor enhancer containing a proprietary stain-blocking additive that meets the maximum VOC content limits of 100 g/L for sealers as required by the South Coast Air Quality Management District requirements, as well as the 400 g/L VOC maximum required by the U.S. EPA Architectural Coatings Rule.
 - 3. SLIP-RESISTANT ADDITIVE is a micronized polymer with low-oil absorption and high-solvent resistance so it easily stirs into most oil-based and water-based paints and other coatings. Low density allows it to stay well suspended in thin materials like stains and sealers.
- B. Basis of Design Specification:
 - 1. Concrete densifier and chemical hardener compound: LIQUI-HARD ULTRA manufactured by W. R. MEADOWS.
 - 2. Concrete enhancer: BELLATRIX® manufactured by W. R. MEADOWS.

2.03 RELATED MATERIALS

- A. Water: Potable water.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive concrete densifier and chemical hardener. Notify architect if surfaces are not acceptable. Do not begin application until unacceptable conditions have been corrected.
- B. Ensure material can penetrate the concrete surface.

3.02 SURFACE PREPARATION

- A. Protect adjacent surfaces not designated to receive treatment.
- B. Clean and prepare surfaces to receive treatment in accordance with manufacturer's instructions, ensuring that all stains, oil, grease, form release agents, curing compounds, dust, and dirt are removed prior to application.
- C. Fill and repair all holes, cracks, and deteriorated areas that have been removed to sound concrete.

3.03 APPLICATION

- A. Apply concrete densifier and chemical hardener in accordance with manufacturer's instructions.
- B. Ensure application equipment is clean and free of previously used materials.
- C. Do not dilute concrete densifier and chemical hardener.
- D. Fresh Concrete
 - 1. Apply undiluted concrete densifier and chemical hardener as soon as concrete is firm enough to work on after final troweling.
 - 2. Apply undiluted concrete densifier and chemical hardener at approximately 650 - 800 ft.²/gal. (15.95 – 19.63 m²/L) using a low-pressure sprayer.
 - 3. Do not allow material to puddle on the surface.
- E. Existing Concrete
 - 1. Apply undiluted concrete densifier and chemical hardener using a low pressure sprayer.
 - 2. Keep the surface wet with concrete densifier and chemical hardener for a minimum 20-minute period.
 - 3. Do not allow material to puddle on the surface.
 - 4. Let the surface dry for 2-4 hours.
 - 5. Restrict foot traffic for at least 4 hours; 12 hours is preferable.

3.04 CONCRETE ENHANCER

- A. Allow 24 hours before proceeding with concrete enhancer application.
- B. Spray concrete enhancer full strength from container using an industrial sprayer delivering 1/10th of a gallon per minute.
- C. Pre-wet micro-fiber applicator with concrete enhancer prior to use.
- D. Uniformly spread concrete enhancer with a micro-fiber applicator, ensuring that the product is not allowed to dry before spreading is complete. Special caution should be taken to not over apply. A monolithic, thin, even film is desired.
- E. For optimum performance, apply a second coat at a 90° (right) angle to the first coat, after the first coat is thoroughly dry.
- F. Allow 24 hours for concrete enhancer to dry.

3.05 PROTECTION

- A. Keep surface dry for a minimum of 48 hours after application (preferably 72 hours).

END OF SECTION

**SECTION 051200
STRUCTURAL STEEL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members.
- B. Base plates, shear stud connectors and _____.
- C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Section 052100 - Steel Joist Framing.
- B. Section 053100 - Steel Decking: Support framing for small openings in deck.
- C. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2024).
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- E. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
- F. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.
- G. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.
- H. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.
- I. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.
- J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.
- K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- O. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.
- P. SSPC-SP 3 - Power Tool Cleaning; 2018.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections not detailed.

3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Fabricator: Company specializing in performing the work of this section with minimum 5 years of experience.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.
- D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- E. Erector: Company specializing in performing the work of this section with minimum 6 years of experience.
- F. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Angles and Plates: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- E. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.
- F. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.
- G. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers.
- H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- I. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).
 3. Height Change, Plastic State; when tested according to ASTM C827/C827M:
 - a. Maximum: Plus 4 percent.
 - b. Minimum: Plus 1 percent.
- J. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

- A. Prepare structural component surfaces in accordance with SSPC-SP 3.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components indicated on shop drawings.
- D. Do not field cut or alter structural members without approval of Architect.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- F. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts," testing at least 10 percent of bolts at each connection.
- C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

END OF SECTION

**SECTION 052100
STEEL JOIST FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Open web steel joists, with bridging, attached seats and anchors.
- B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
- C. Supplementary framing for roof openings greater than 18 inches (450 mm).

1.02 RELATED REQUIREMENTS

- A. Section 051200 - Structural Steel Framing: Superstructure framing.
- B. Section 053100 - Steel Decking: Bearing plates and angles.
- C. Section 055000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- D. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
- E. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.
- F. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.
- G. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- J. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.
- K. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.
- L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- M. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.05 QUALITY ASSURANCE

- A. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

- B. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.
- D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- E. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Joists:
 1. Canam Group Inc: www.canam-steeljoists.ws
 2. New Millennium Building Systems: www.newmill.com/#sle.
 3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Open Web Joists: SJI Type K Joists:
 1. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
 2. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
 3. Finish: Shop primed.
- B. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.
- C. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.
- D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.
- E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

- A. Frame special sized openings in joist web framing as detailed.

2.04 FINISH

- A. Shop prime joists as specified.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 ERECTION

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

- C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
- D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- E. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).
- F. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- G. Do not field cut or alter structural members without approval of joist manufacturer.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

END OF SECTION

**SECTION 053100
STEEL DECKING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof deck.
- B. Metal form deck.
- C. Supplementary framing for openings up to and including 18 inches (450 mm).
- D. Bearing plates and angles.

1.02 RELATED REQUIREMENTS

- A. Section 051200 - Structural Steel Framing: Support framing for openings larger than 18 inches (450 mm).
- B. Section 052100 - Steel Joist Framing: Support framing for openings larger than 18 inches (450 mm) and shear stud connectors.
- C. Section 055000 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. 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; 2023, with Editorial Revision.
- D. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- F. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- G. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

1.05 QUALITY ASSURANCE

- A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.
- C. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Deck:
 - 1. Canam Steel Corporation; _____: www.canam-steeljoists.ws.
 - 2. New Millennium Building Systems; _____: www.newmill.com/#sle.
 - 3. Nucor-Vulcraft Group; _____: www.vulcraft.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.

2.02 STEEL DECK

- A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.
 - 1. Calculate to structural working stress design and structural properties specified.
- B. Roof Deck: Non-composite type, fluted steel sheet:
 - 1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
 - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
 - 3. Minimum Base Metal Thickness: 22 gauge, 0.0299 inch (0.76 mm).
 - 4. Nominal Height: 1-1/2 inch (38 mm).
 - 5. Side Joints: Lapped, mechanically fastened.
 - 6. End Joints: Lapped, welded.
- C. Metal Form Deck: Corrugated sheet steel, with provision for ventilation of concrete:
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
 - 2. Minimum Base Metal Thickness: As indicated on drawings.
 - 3. Nominal Height: As indicated on drawings.
 - 4. Side Joints: Lapped, welded.
 - 5. End Joints: Lapped, welded.

2.03 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.
- B. Welding Materials: AWS D1.1/D1.1M.
- C. Fasteners: Galvanized hardened steel, self tapping.
- D. Weld Washers: Mild steel, uncoated, 3/4 inch (19 mm) outside diameter, 1/8 inch (3 mm) thick.

2.04 FABRICATED DECK ACCESSORIES

- A. Sheet Metal Deck Accessories: Metal closure strips and cover plates, 22 gauge, 0.0299 inch (0.76 mm) thick sheet steel; of profile and size as indicated; finished same as deck.
- B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch (1.90 mm) minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches (38 mm) below roof deck surface, bearing flange 3 inches (75 mm) wide, sealed watertight.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.

- C. Fasten deck to steel support members at ends and intermediate supports at 12 inches (300 mm) on center maximum, parallel with the deck flute and at each transverse flute using methods specified.
 - 1. Welding: Use fusion welds through weld washers.
- D. At mechanically fastened male/female side laps fasten at 24 inches (600 mm) on center maximum.
- E. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.
- F. At welded male/female side laps weld at 18 inches (450 mm) on center maximum.
- G. Weld deck in accordance with AWS D1.3/D1.3M.
- H. At deck openings from 6 inches (150 mm) to 18 inches (450 mm) in size, provide 2 by 2 by 1/4 inch (50 by 50 by 6 mm) steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.
- I. At deck openings greater than 18 inches (450 mm) in size, provide steel angle reinforcement. as specified in Section 051200.
- J. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch (150 mm) minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches (300 mm) on center maximum.
- K. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
- L. Place metal cant strips in position and fusion weld.
- M. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.
- N. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

**SECTION 054000
COLD-FORMED METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall framing.
- B. Water-resistive barrier over sheathing.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.
- C. Design Data:

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 PERFORMANCE REQUIREMENTS

- A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.
- B. Design Criteria: In accordance with applicable codes.
 - 1. Live load deflection meeting the following, unless otherwise indicated:
 - 2. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - 3. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

- A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

2.05 CONNECTIONS

PART 3 EXECUTION

3.01 PREPARATION

3.02 INSTALLATION - GENERAL

- A. Install structural members and connections in compliance with ASTM C1007.

3.03 INSTALLATION OF STUDS

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.

3.05 TOLERANCES

END OF SECTION

**SECTION 061053
MISCELLANEOUS ROUGH CARPENTRY**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Miscellaneous lumber.
4. Plywood backing panels.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for sheathing, subflooring, and underlayment.
2. Section 06 4023 "Interior Architectural Woodwork" for interior wood stairs and railings.

1.2 DEFINITIONS

- A. Boards or Strips:** Lumber of less than **2 inches nominal** size in least dimension.
- B. Dimension Lumber:** Lumber of **2 inches nominal** size or greater but less than **5 inches nominal** size in least dimension.
- C. Exposed Framing:** Framing not concealed by other construction.
- D. Lumber grading agencies, and abbreviations used to reference them, include the following:**
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. SPIB: The Southern Pine Inspection Bureau.
 4. WCLIB: West Coast Lumber Inspection Bureau.
 5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data:** For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.**

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
 4. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
1. Boards: 15 percent.
 2. Dimension Lumber: 15 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1, Use categories as follows:

UC1: Interior construction not in contact with ground or subject to moisture. Include all rough carpentry. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

2. After treatment, redry dimension lumber to 19 percent maximum moisture content.
- B. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than **18 inches** above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 MISCELLANEOUS LUMBER

- A. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- B. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, in thickness indicated or, if not indicated, not less than **3/4-inch** nominal thickness.

2.5 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than **1-1/2 inches** into wood substrate.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.

2.6 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets:
 - 1. Closed-cell neoprene foam, **1/4 inch** thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch**.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- F. Do not splice structural members between supports unless otherwise indicated.

- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches** o.c.
- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than **96 inches** o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and **2-inch nominal** thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft.** and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than **20 feet** o.c.
- I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.
- M. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

**SECTION 061600
CONCRETE FINISHING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Sheathing joint-and-penetration treatment materials.

B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for plywood backing panels.
2. Section 07 2500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.
- B. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.
 - 1. Installer is to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and is to employ ABAA-certified installers and supervisors on Project.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- B. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing Performance: Air-barrier and water-resistant glass-mat gypsum sheathing assembly, and seals with adjacent construction, are to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies are to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, tie-ins to other installed air barriers, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
2. Type and Thickness: Regular, **5/8 inch** thick.
3. Size: **48 by 96 inches** for vertical installation.

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 1. For steel framing less than **0.0329 inch** thick, use screws that comply with ASTM C1002.
 2. For steel framing from **0.033 to 0.112 inch** thick, use screws that comply with ASTM C954.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum **2 inches** wide, **10 by 10 or 10 by 20 threads/inch**, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

- D. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANEL

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 1. Wall and Roof Sheathing:
 - a. Screw to cold-formed metal framing.
 - b. Space panels **1/8 inch** apart at edges and ends.

3.3 INSTALLATION OF GYPSUM SHEATHING

- A. Comply with GA-253 and with manufacturer's written instructions.
 1. Fasten gypsum sheathing to wood framing with screws.
 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 3. Install panels with a **3/8-inch** gap where non-load-bearing construction abuts structural elements.
 4. Install panels with a **1/4-inch** gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
 1. Space fasteners approximately **8 inches** o.c. and set back a minimum of **3/8 inch** from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION

**SECTION 064100
ARCHITECTURAL WOOD CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Hardware.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 123600 - Countertops.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. BHMA A156.9 - Cabinet Hardware; 2020.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: Full-size details, minimum.
 - 2. Show locations of sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other sections.
 - 3. Show locations and sizes of cutouts and holes for items installed in plastic laminate architectural cabinets.
 - 4. Provide information as required by AWI/AWMAC/WI (AWS).
- C. Product Data: For each type of product, including cabinet hardware and accessories.
- D. Samples: Submit samples minimum 8 inches (200 mm) square, illustrating proposed plastic laminate and PVC edgebanding .
- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
 - 2. Single Source Responsibility: Provide and install this work from single fabricator.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.08 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
- C. Establish Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Cabinets:
 - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 - 3. Finish - Semi-Exposed Surfaces: CLS
 - 4. Finish - Concealed Surfaces: Manufacturer's option.
 - 5. Door and Drawer Front Edge Profiles: Square edge with thick PVC applied band.
 - 6. Door and Drawer Front Retention Profiles: Fixed panel.
 - 7. Casework Construction Type: Type A - Frameless.
 - 8. Interface Style for Cabinet and Door: Style 1 - Overlay; Full Overlay.
 - 9. Patterned Face Layout for Cabinet and Door Fronts:
 - a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
 - 10. Adjustable Shelf : 3/4" thick for shelves up to 32" wide and 1" thick for shelves more than 32" wide.
 - a. Any shelves more than 32" wide use TFL core.
 - 11. Cabinet Style: Full Overlay.
 - 12. Cabinet Doors and Drawer Fronts: Flush style.
 - 13. Drawer Side Construction: Doweled.
 - 14. Drawer Construction Technique: Dowel joints.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 PANEL CORE MATERIALS

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
 - 1. Grade: M-2; moisture resistance: MR10.
 - 2. Panel Thickness: 3/4 inch (19.1 mm).

2.04 THERMALLY FUSED LAMINATE PANELS

- A. Thermally Fused Laminate (TFL): Melamine-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
 - 1. Test in accordance with NEMA LD 3 Section 3.
 - 2. Panel Core Substrate: Particleboard.
 - 3. Color: White.

2.05 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. Arborite: www.arborite.com/#sle.
 - 2. Formica Corporation: www.formica.com/#sle.
 - 3. Panolam Industries International, Inc: www.panolam.com/#sle.
 - 4. Wilsonart LLC: www.wilsonart.com/#sle.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as indicated.
 - 1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, color &, finish as indicated on Drawings.
 - 2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, color, finish as indicated on Drawings.
 - 3. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, colors as indicated, finish as indicated.

2.06 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; of width to match component thickness.
 - 1. Color: As selected by Architect from manufacturer's standard range.
 - 2. Use 3mm thickness on door and drawer edges
 - 3. Use .018 thickness on cabinet box edge
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.

2.07 HARDWARE

- A. Cabinet Hardware: Comply with BHMA A156.9 for hardware grades indicated below:
 - 1. Product Grade: As required by specified woodworking quality grade.
- B. Cabinet Pulls (HP-1 Typical): Berenson Advantage Wire Pull #6246-2BPN-P
 - 1. Backmounted, solid metal, 4.00-inch long on center, brushed nickel finish.
- C. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, manufacturer's standard metal finish, for nominal 1 inch (25 mm) spacing adjustments.
- D. Shelf Support Brackets: Fixed, L-shaped, corner reinforced, face-of-stud mounting.
 - 1. Materials: Formed steel shapes.
 - a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
 - b. Color: Manufacturer's full range.
- E. Drawer Slides:
 - 1. Type: Full extension.
 - 2. Static Load Capacity: Commercial grade.

- a. Standard Weight Capacity: 100 pound minimum.
- b. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide.
- 3. Static Load Capacity: Heavy Duty Grade (Standard drawers).
 - a. Standard Weight Capacity: 100 pound minimum.
 - b. For drawers more than 6 inches high or more than 24" wide
- 4. Static Load Capacity: Extra Heavy Duty Grade (File Cabinets and Trash Pullout).
 - a. Standard Weight Capacity: 150 pound minimum.
 - b. For drawers more than 6 inches high or more than 24 inches wide.
- 5. Mounting: Bottom mounted.
- 6. Material: Zinc-plated steel with polymer rollers.
- 7. Stops: Positive type.
- F. Soft-Close, Door and Drawer Adjustable Dampers:
 - 1. Basis-of-Design: ball bearing drawer slide.
- G. Hinges: European style concealed self-closing type, BHMA No. B01602 , steel with satin finish.
 - 1. 120 degree of opening (Typical).
 - 2. 90 Degree of opening at all cabinets installed adjacent to a wall.
- H. Hooks: Surface-mounted; stainless steel, satin finish.

2.08 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Provide cutouts for plumbing fixtures, appliances, and outlet boxes. Verify locations of cutouts from on-site dimensions. Seal cut edges.
 - 1. Verify all dimensions of appliances before fabrication.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.

3.03 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

- C. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- D. Clean, lubricate, and adjust hardware.
- E. Clean cabinets on exposed and semi-exposed surfaces.

3.04 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

**SECTION 072100
THERMAL INSULATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.
2. Section 07 2119 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
3. Section 07 5323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.
4. Section 07 4210.21 - Continuous Insulation (Ci) With Composite Metal Hybrid (CMH) Sub-Framing System

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Polyisocyanurate foam-plastic board insulation.
3. Glass-fiber blanket insulation.

1.4 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

1. Sign, date, and post the certification in a conspicuous location on Project site.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV : ASTM C578, Type IV, **25-psi** minimum compressive strength; unfaced.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Chemical Company (The).
 - b. Owens Corning.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation **12 inches** and wider in width.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Foil Faced : ASTM C1289, foil faced, Type I, Class 1 or 2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. Dow Chemical Company (The).
 - d. Firestone Building Products.
 - e. Hunter Panels.
 - f. Johns Manville; a Berkshire Hathaway company.
 - g. Rmax, Inc.
 - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced : ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. CertainTeed Insulation.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Owens Corning.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of **24 inches** below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of **24 inches** in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately **24 inches** o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.
3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 2000 "Unit Masonry."

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain **3-inch** clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed **96 inches**, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward exterior of construction.
 - b. Interior Walls: Set units with facing placed as indicated on Drawings.

3.7 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass.
2. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
3. Install insulation to fit snugly without bowing.

3.8 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

**SECTION 072119
FOAMED-IN-PLACE INSULATION**

PART 1 - GENERAL

PART 2 - GENERAL

2.1 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam insulation.
2. Accessories.

B. Related Requirements:

1. Section 07 2100 "Thermal Insulation" for foam-plastic board insulation.

2.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

2.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each product, for tests performed by qualified testing agency.

B. Qualification Statements: For Installer.

2.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 3 - PRODUCTS

3.1 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation.

- b. Carlisle Spray Foam Insulation.
 - c. Demilec (USA) LLC.
 - d. Henry Company.
 - e. Johns Manville; a Berkshire Hathaway company.
2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- a. Flame-Spread Index: or less.

3.2 ACCESSORIES

- A. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.
 - 1. Gypsum Wallboard: 0.5-inch minimum thickness.
- B. Ignition Barrier: Material providing a 15-minute minimum fire-ignition barrier.
 - 1. Gypsum Wallboard: 0.325-inch minimum thickness.
 - 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.

PART 4 - EXECUTION

4.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

4.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Cavity Walls: Install into cavities to thickness indicated on Drawings.

- F. Miscellaneous Voids: Apply according to manufacturer's written instructions.
- G. Install thermal barrier material.
 - 1. Do not cover insulation prior to any required spray foam insulation inspections.
- H. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.
 - 1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
 - 2. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
 - 3. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

4.3 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION

**SECTION 072616
UNDERSLAB VAPOR BARRIER**

PART 1 – GENERAL

1.1 SUMMARY

Products supplied under this section:

1. Vapor barrier and installation accessories for installation under concrete slabs.

Related sections:

1. Section 03 30 00 Cast-in-Place Concrete

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
1. ASTM E1745- 11 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 2. ASTM E1643- 11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. Technical Reference - American Concrete Institute (ACI):
1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
 2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

1.3 SUBMITTALS

- A. Quality control/assurance:
1. Summary of test results per paragraph 9.3 of ASTM E1745.
 2. Manufacturer's samples and literature.
 3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
 4. Manufacturer of textured tape must supply testing summary to verify the product demonstrates adhesion to both the manufacturer's vapor retarder/barrier and to freshly-placed concrete.
 5. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Vapor barrier shall have all of the following qualities:
1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
 2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 15 mils minimum
 3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1.

2.2 ACCESSORIES

- A. All accessories must be from the same manufacturer of the vapor barrier material used, or must be approved by the vapor barrier manufacturer.
 - 1. Seams
 - a. Approved seam tape.
 - 2. Sealing Permanent penetrations of Vapor barrier
 - a. Approved vaporproofing mastic.
 - b. Approved tape.
 - 3. Perimeter edge/seal
 - a. Approved tape with a textured surface that creates a mechanical seal to freshly-placed concrete.
 - b. Approved termination bar.
 - c. Approved double-sided sealant tape.
 - 4. Non-permanent penetration prevention
 - a. Approved peel-and-stick, stake base/foot.
 - 5. Vapor Barrier-Safe Screed System
 - a. Approved vapor barrier-safe, fixed elevation, point-to-point guide screed system.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
 - 1. Level and compact base material.

3.2 INSTALLATION

- A. Install vapor barrier in accordance ASTM E1643.
 - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 - 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 - a. Seal vapor barrier to the entire perimeter wall or footing/grade beam with double-sided tape, or both termination bar and double-sided tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
 - 3. Overlap joints 6 inches and seal with manufacturer's seam tape.
 - 4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
 - 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use blunt-end and/or threaded nail stakes (screed pad posts) and insert them into peel-and-stick stake base/foot. Ensure stake base/foot's peel-and-stick adhesive base is fully adhered to the vapor barrier.
 - 7. If non-permanent stakes must be driven through vapor barrier, repair as recommended by vapor barrier manufacturer.

8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
10. For vapor barrier-safe concrete screeding applications, install vapor barrier-safe, fixed elevation, point-to-point guide screed system prior to placing concrete.

END OF SECTION

**SECTION 072726
FLUID-APPLIED MEMBRANE AIR BARRIER**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vapor-permeable, fluid-applied air barriers.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.2 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer to be licensed by ABAA according to ABAA's Quality Assurance Program and to employ ABAA-certified installers and supervisors on Project.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum **0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.**, when tested according to ASTM E2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of **17 to 30 mils** over smooth, void-free substrates.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Industrial Adhesives and Tapes Division.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. DuPont de Nemours, Inc.
 - d. Hohmann & Barnard, Inc.
 - e. Sto Corp.
 - f. W.R. Meadows, Inc.
 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum **0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft.** pressure difference; ASTM E2178.
 - b. Vapor Permeance: Minimum **5 perms**; ASTM E96/E96M, Procedure A, Desiccant Method.
 - c. Ultimate Elongation: Minimum 250 percent; ASTM D412, Die C.
 - d. Adhesion to Substrate: Minimum **16 lbf/sq. in.** when tested according to ASTM D4541.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. The Dow Chemical Company.
 - c. Tremco Incorporated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D4263.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

2. Install transition strip on roofing membrane or base flashing so that a minimum of **3 inches** of coverage is achieved over each substrate.
 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply preformed silicone extrusion so that a minimum of **3 inches** of coverage is achieved over each substrate. Maintain **3 inches** of full contact over firm bearing to perimeter frames, with not less than **1 inch** of full contact.
1. Transition Strip: Roll firmly to enhance adhesion.
 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional **6-inch-** wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending **6 inches** beyond repaired areas in strip direction.
- 3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION
- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
 - C. Do not cover air barrier until it has been tested and inspected by testing agency.
 - D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 2. Air-barrier dry film thickness.
 3. Continuous structural support of air-barrier system has been provided.
 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 5. Site conditions for application temperature and dryness of substrates have been maintained.
 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 7. Surfaces have been primed, if applicable.
 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 9. Termination mastic has been applied on cut edges.
 10. Strips and transition strips have been firmly adhered to substrate.
 11. Compatible materials have been used.
 12. Transitions at changes in direction and structural support at gaps have been provided.
 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 14. All penetrations have been sealed.
- D. Tests: As determined by testing agency from among the following tests:
 1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers .

2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E783.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D4541 for each 600 sq. ft. of installed air barrier or part thereof.

E. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

**SECTION 074213
METAL WALL PANELS**

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. This section covers the pre-finished, pre-fabricated Architectural metal wall panel system. All metal trim, accessories, fasteners, insulation and sealants indicated on the drawings as part of this section.
- B. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.2 SUMMARY

- A. Section Includes
 - 1. Factory formed metal wall panels
- B. Related work specified elsewhere. (Note: select from the below or add appropriate sections)
 - 1. Metal Roof Deck: Division 5 – Metal Deck Sections
 - 2. Wood Framing and Decking: Division 6 Roof Carpentry Section
 - 3. Flashing and Trim: Division 7- Flashing and Sheet Metal
 - 4. Coping and Gravel Stops: Division 7 Roof Specialties and Accessories
 - 5. Sealants: Division 7 Joint Sealers Sections

1.3 DEFINITIONS

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal, and accessories necessary for a complete weathertight system.

1.4 QUALITY ASSURANCE

- A. MBCI products establish a minimum of quality required.
- B. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.

- C. Sheet Metal Industry Standard: Comply with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) *Architectural Sheet Metal Manual*.
- D. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.5 SUBSTITUTIONS

- A. The material, products and equipment specified in this section establish a standard for required function, dimension, appearance and quality to be met by any proposed substitution.

1.6 SYSTEM DESCRIPTION

- A. Material to comply with:
 - ASTM A792/A792M Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip process – 22 GA
 - ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate - .032 and .040 Aluminum

1.7 WALL SYSTEM PERFORMANCE TESTING

- A. General Performance: Metal wall panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
- B. Panels to meet:
 - 1. Wall System shall be designed to meet applicable Local Building Code and the Soffit System shall have been tested by the Manufacturer per ASTM E-330 and have the applicable Load Tables published from this Air Bag testing for negative loads.

1.8 WARRANTIES

- A. Finish warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finish within specified warranty period.
 - 1. Exposed Panels Finish – deterioration includes the following:
 - a. Color fading more than 5 hunter units when tested according to ASTM D 2244
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214
 - c. Cracking, checking, peeling or failure of a paint to adhere to a bare metal.
 - 2. Warranty Period: 30 Years from the date of substantial completion

1.9 SUBMITTALS

- A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.

- B. Provide finish samples of all colors specified.
- C. Shop drawings: Show fabrication and installation layouts of metal wall panels or metal soffit panels, details of edge conditions, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work
- D. Coordination Drawings: Plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installer of the items involved.
- E. LEED Submittals
 - 1. Product data for Credit MR 4.1 and credit MR 4.2: Indicating the percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Ordering: Comply with manufacturer's ordering instruction and lead time requirements to avoid construction delays.
- B. Deliver components, sheets, metal wall panels and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
- C. Unload, store and erect metal wall panels in a manner to prevent bending, warping, twisting and surface damage.
- D. Stack metal wall panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness. Do not store metal wall panels in contact with other materials that might cause staining, denting or other surface damage.
- E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.11 PROJECT CONDITIONS

- A. Weather Limitations: proceed with installation only when existing and forecasted weather conditions permit metal wall panel work to be performed.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.12 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports and roof penetrations with actual equipment provided.
- B. Coordinate metal roof panels with rain drainage work, flashing, trim and construction of decks, parapet walls and other adjoining work to provide a leakproof, secure and noncorrosive installation.

PART 2 – PRODUCTS

2.1 PANEL DESIGN

- A. General: Provide factory-formed metal wall panels designed for wall, soffit and fascia applications where a flush or flat appearance is desired. A round interlock leg and concealed fastening system act to improve the flush appearance while providing additional strength.
- B. Wall panels shall be standard size and profile from all options in MBCI catalogue.
- C. Panels to be produced smooth.
- D. Forming: Use continuous end rolling method. No end laps on panels. No portable rollforming machines will be permitted on this project, no installer-owned or installer-rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.

2.2 ACCEPTABLE MANUFACTURERS

- A. This project is detailed around the metal wall product of MBCI's Flush or Reveal panel.

2.3 MATERIALS AND FINISHES

- A. Preformed metal panels shall be fabricated of, 22 GA galvalume steel, .032" thick 3105-H14 aluminum, .040" thick 3105-H14 aluminum.
- B. Color shall be available from the entire color chart from MBCI.
- C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.
- D. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
- E. Accessories/Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates. Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the wall panel system. Exposed fasteners shall

not restrict free movement of the roof panel system resulting from thermal forces, except at designed points of roof panel fixity

F. Sealants

1. Provide two-part polysulfide class B non-sag type for vertical and horizontal joints or
2. One part polysulfide not containing pitch or phenolic extenders or
3. Exterior grade silicone sealant recommended by roofing manufacturer or
4. One part non-sag, gun grade exterior type polyurethane recommended by the roofing manufacturer.

2.4 FABRICATION

- A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
 1. Max panel length is 25'. Check with manufacturer regarding longer lengths.
- B. Fabricate components of the system in factory, ready for field assembly.
- C. Fabricate components and assemble units to comply with fire performance requirements specified.
- D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.
- B. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FASTENERS

- A. Secure units to supports
- B. Place fasteners as indicated in manufacturer's standards.

3.3 INSTALLATION

- A. Compliance: Comply with manufacturer's product data, recommendations and installation instructions for substrate verification, preparation requirements and installation.
- B. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.

- C. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.
- D. Provide uniform, neat seams.
- E. Fasteners: Conceal fasteners where possible in exposed work. Cover and seal fasteners and anchors for watertight and leakproof installation.
- F. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.4 DAMAGED MATERIAL

- A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

3.5 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damage installed products. Clean installed products in accordance with manufacturer's instruction prior to owners acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION

**SECTION 074646
FIBER-CEMENT SIDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiber-cement siding.

1.02 RELATED REQUIREMENTS

- A. Section 054000 - Cold-Formed Metal Framing: Water-resistive barrier under siding.
- B. Section 061000 - Rough Carpentry: Water-resistive barrier under siding.
- C. Section 072500 - Weather Barriers: Water-resistive barrier under siding.
- D. Section 092116 - Gypsum Board Assemblies: Siding substrate.
- E. Section 099113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- B. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2022, with Editorial Revision (2023).
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.
- E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Manufacturer's requirements for related materials to be installed by others.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods, including nail patterns.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, _____, and methods of anchorage.
- D. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- H. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.
- I. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified in this section with not less than three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver and store materials in manufacturer's unopened packaging, with labels intact, until ready for installation.
- C. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.
- D. Protect materials from harmful environmental elements, construction dust, and other potentially detrimental conditions.

1.07 FIELD CONDITIONS

- A. Do not install panels when air temperature or relative humidity are outside manufacturer's limits.

1.08 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.
- C. Manufacturer Warranty: Provide manufacturer warranty for years as indicated under Fiber-Cement Siding article sub-headings for "Warranty". Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Style: Standard lap style.
 - 2. Texture: Smooth.
 - 3. Length: 12 feet (3.7 m), nominal.
 - 4. Width (Height): 5-1/4 inches (133 mm).
 - 5. Thickness: 5/16 inch (8 mm), nominal.
 - 6. Finish: Unfinished.
 - 7. Color: As indicated on drawings.
 - 8. Color: As selected by Architect from manufacturers full range of available colors.
 - 9. Warranty: 50 year limited; transferable.
 - 10. Products:
 - a. Allura, a division of Plycem USA, Inc; _____: www.allurausa.com/#sle.
 - b. James Hardie Building Products, Inc; _____: www.jameshardie.com/#sle.
 - c. Nichiha USA, Inc; _____: www.nichiha.com/#sle.
 - d. _____.
 - e. Substitutions: See Section 016000 - Product Requirements.
- B. Plank Siding: Plank boards comprised of cement, mineral fillers, cellulose and nontoxic fibers, with through-colored construction, complying with ASTM E84, ASTM E136 and NFPA 285, Type A; with both face-fastening and concealed mechanical fastening systems.
 - 1. Texture: Blast.
 - 2. Length (Height): 96 inches (2400 mm), nominal.
 - 3. Width: 48 inches (1220 mm).
 - 4. Finish: Factory applied hydrophobic sealer.
 - 5. Color: Through body color with edges and holes.
 - 6. Color: As selected by Architect from manufacturer's full range of available colors.
 - 7. Warranty: 10 years.

- 8. Products:
 - a. exo Surfaces; KOL High Density Fibre Cement: www.exo-surfaces.com/#sle.
- C. Soffit Panels: Smooth panels of same material and finish.
- D. Soffit Panels: Panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
 - 1. Texture: Smooth.
 - 2. Length: 96 inches (2440 mm), nominal.
 - 3. Width: 48 inches (1220 mm).
 - 4. Thickness: 5/16 inch (7.9 mm), nominal.
 - 5. Finish: Unfinished.
 - 6. Color: As indicated on drawings.
 - 7. Color: As selected by Architect from manufacturers full range of available colors.
 - 8. Manufacturer: Same as siding.
- E. Factory Finish: Monochromic topcoat.
 - 1. Products:
 - a. Sherwin-Williams Company; KEM AQUA BP Siding Plus: oem.sherwin-williams.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.02 ACCESSORIES

- A. Support for Cladding and Continuous Insulation: Thermal clips.
 - 1. Thermally-broken clips that provide attachment support for girts, angles, channels, and other cladding support framing.
 - 2. Thermal Spacer Clip: Polyamid resin.
 - 3. Galvanized Steel Support Clip: 14 gauge, 0.0747 inch (1.90 mm), G90/Z275 galvanized support clip complying with ASTM A653/A653M, with integral glass fiber reinforced polyamide thermal isolator pad.
 - 4. Stainless Steel Support Clip: 14 gauge, 0.0781 inch (1.98 mm) Type 304 stainless steel, with thermal isolator pad.
 - 5. Spacing of Clips: 16 inches (406 mm) on center, vertically.
 - 6. Fasteners: As recommended by clip manufacturer.
 - 7. Products:
 - a. Northern Facades; ISO Clip: www.northernfacades.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Support for Cladding and Continuous Insulation: Continuous thermal Z-girts.
 - 1. Fiberglass reinforced plastic (FRP) girts that provide cladding attachment support for exterior wall cladding, brick veneer, CMU veneer, metal wall panels, siding, and _____.
 - 2. Depth : As required for thickness of insulation.
 - 3. Length: 6 inches (152 mm) for clips and 96 inches (2438 mm) for girts.
 - 4. Spacing: 16 inches (406 mm) on center, vertically.
 - 5. Fasteners: As recommended by clip manufacturer.
 - 6. Products:
 - a. Cladiator; Slotted-Z FG: www.cladiator.com/#sle.
 - b. exo Surfaces; exoGIRT: www.exo-surfaces.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
- C. Support for Cladding and Continuous Insulation: Thermal clip and rail.
 - 1. Thermal Clips: Extruded aluminum, with thermal spacer at base and slot at top to allow field adjustment and alignment of rails.
 - 2. Extruded vertical and horizontal aluminum rails.
 - 3. Fasteners: Provide support system and cladding attachment fasteners as recommended by system manufacturer in accordance with requirements.

- D. Support for Cladding and Continuous Insulation: Horizontal self-shimming, adjustable aluminum framing system thermally isolated from building substrate. Noncombustible in accordance with NFPA 285.
 - 1. Fasteners: Provide support system and cladding attachment fasteners as recommended by system manufacturer in accordance with requirements. Provide materials and engineering from same source.
- E. Trim: Same material and texture as siding.
- F. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inches (31.8 mm), minimum.
- G. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Do not begin until unacceptable conditions have been corrected.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Protect surrounding areas and adjacent surfaces during execution of this work.

3.03 INSTALLATION

- A. Install siding in accordance with manufacturer's instructions and recommendations.
 - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
 - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
 - 3. Use trim details as indicated on drawings.
 - 4. Touch up field cut edges before installing.
 - 5. Pre-drill nail holes if necessary to prevent breakage.
- B. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.
- C. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- D. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.
- E. Do not install siding less than 6 inches (152 mm) from ground surface, or closer than 1 inch (25.4 mm) to roofs, patios, porches, and other surfaces where water may collect.
- F. Exterior Soffit Vents: Install in accordance with manufacturer's written instructions and at locations indicated on drawings; provide vent area as indicated on drawings.
- G. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.
- H. Finish Painting: See Section 099113.
- I. Finish Painting: Within one week after installation, paint siding and trim with one coat primer and two coats finish paint.

3.04 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean faced panels in accordance with manufacturer's maintenance instructions, using cleaning materials and methods acceptable to manufacturer.

3.05 PROTECTION

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 075323
ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Accessory roofing materials.
3. Substrate board at acoustical perforated deck locations.
4. Vapor retarder at acoustical perforated deck locations.
5. Roof insulation.
6. Insulation accessories and cover board.
7. Walkways.

B. Section includes installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 05 3100 "Steel Decking."

C. Related Requirements:

1. Section 06 1000 "Rough Carpentry for wood nailers, curbs, and blocking and for wood-based, structural-use roof deck panels.
2. Section 06 1600 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 07 2100 "Thermal Insulation" for insulation beneath the roof deck.
4. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 07 7100 "Roof Specialties" for manufactured copings and roof edge flashings.
6. Section 07 7129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint assemblies.
7. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
8. Section 22 1423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation, thickness, and slopes.
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with air barrier.
- C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- C. Evaluation Reports: For components of roofing system, from ICC-ES.
 1. Field Test Reports:

2. Concrete internal relative humidity test reports.
3. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturers: A qualified manufacturer that is UL listed listed in FM Approvals' RoofNav for roofing system identical to that used for this Project.
 2. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, roof pavers, and other components of roofing system.
 - 2. Warranty Period: 20 years from Date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings to remain watertight.
 - 1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
 - 1. Zone 1' (Roof Area Field) 34.4 lbf/sq. ft.
 - 2. Zone 1 (Roof Area Field): < 59.9 lbf/sq. ft.>.
 - 3. Zone 2 (Roof Area Perimeter): < 78.9 lbf/sq. ft.>.
 - 4. Zone 3 (Roof Area Corners): < 107.6 lbf/sq. ft.>.
- D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.

- E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D4637/D4637M, Type I, nonreinforced, self-adhering EPDM sheet with factory-applied seam tape.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Firestone Building Products.
 - c. GenFlex Roofing Systems.
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. Mule-Hide Products Co., Inc.
 - f. Versico Roofing Systems.
 - 2. Thickness: **60 mils**, nominal.
 - 3. Exposed Face Color: Black.

2.3 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: **60-mil-** thick EPDM, partially cured or cured, according to application.
- C. Protection Sheet: Epichlorohydrin or neoprene nonreinforced flexible sheet, **55 to 60 mils** thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
- D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- E. Roof Vents: As recommended by roof membrane manufacturer.
- F. Bonding Adhesive: Manufacturer's standard.
- G. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- H. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and **3-inch-** wide minimum, butyl splice tape with release film.
- I. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- J. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

- K. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- L. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- M. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.
- N. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.4 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
 - 2. Thickness: 1/2 inch.

2.5 VAPOR RETARDER

- A. Polyethylene Film: ASTM D4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm.
 - 1. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.6 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer, approved for use in FM Approvals' RoofNav-listed roof assemblies.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1 felt facer on both major surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation - Polyiso.
 - b. Carlisle SynTec Incorporated.
 - c. Certainteed; SAINT-GOBAIN.

- d. Firestone Building Products.
 - e. Hunter Panels.
 - f. Insulfoam; Carlisle Construction Materials Company.
 - g. Johns Manville; a Berkshire Hathaway company.
- 2. Compressive Strength: 20 psi.
 - 3. Size: 48 by 96 inches.
 - 4. Thickness: Provide continuous insulation R value of R36 minimum for climate zone 6.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
- 1. Material: Match roof insulation.
 - 2. Minimum Thickness: 2 inches min. total at low point of roofs with tapered insulation.
 - 3. Slope:
 - a. Roof Field: 1/4 inch per foot minimum, unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.7 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
- 1. Modified asphaltic, asbestos-free, cold-applied adhesive.
- D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum substrate.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
 - 2. Thickness: 1/2 inch.
 - 3. Surface Finish: Factory primed.

2.8 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.
- 1. Size: Approximately 30 by 30 inches.
 - 2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 3100 "Steel Decking."
 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 5. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than 75 percent, or as recommended by roofing system manufacturer when tested according to ASTM F2170.
 - a. Test Frequency: One test probe per each 1000 sq. ft., or portion thereof, of roof deck, with not less than three test probes.
 - b. Submit test reports within 24 hours of performing tests.
 6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 7. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
 8. Verify that minimum curing period recommended by roof system manufacturer for lightweight insulating concrete roof decks has passed.
 9. Verify any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
 10. Verify adjacent cementitious wood-fiber panels are vertically aligned to within 1/8 inch at top surface.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
1. Submit test result within 24 hours of performing tests.

- a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- D. Install sound-absorbing insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 2715 "Nonbituminous Self-Adhering Sheet Air Barriers." Section 07 2726 "Fluid-Applied Membrane Air Barriers."

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches** in adjacent rows.
 - 1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
 - 2. Tightly butt substrate boards together.
 - 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
 - 5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.
 - 6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of **2 and 6 inches**, respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 - 2. Continuously seal side and end laps with tape.

- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than **24 inches** in adjacent rows and with long joints continuous at right angle to flutes of decking.
 - a. Locate end joints over crests of decking.
 - b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches**.
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding **1/4 inch** with insulation.
 - g. Cut and fit insulation within **1/4 inch** of nailers, projections, and penetrations.
 - h. Loosely lay base layer of insulation units over substrate.
 - i. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than **12 inches** from previous layer of insulation.
 - a. Staggered end joints within each layer not less than **24 inches** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches**.
 - f. Trim insulation so that water flow is unrestricted.
 - g. Fill gaps exceeding **1/4 inch** with insulation.

- h. Cut and fit insulation within **1/4 inch** of nailers, projections, and penetrations.
- i. Loosely lay each layer of insulation units over substrate.
- j.

Mechanically attach layers of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.

Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

3.7 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches** in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Loosely lay cover board over substrate.
 - 5. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F** of equiviscous temperature.
 - b. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - c. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- B. Install slip sheet over cover board and immediately beneath roofing.

3.8 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll membrane roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.
- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

- E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- F. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roofing. Do not apply to splice area of roof membrane.
- G. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.
- H. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.
- I. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- J. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.
 - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 - 2. Apply lap sealant and seal exposed edges of roofing terminations.
 - 3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
- K. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
 - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- L. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.
 - 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 - 2. Apply lap sealant and seal exposed edges of roofing terminations.
- M. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- N. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
- O. Adhere protection sheet over roof membrane at locations indicated.

3.9 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.10 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
 - 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - c. Top and bottom of each roof access ladder.
 - d. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - e. Locations indicated on Drawings.
 - f. As required by roof membrane manufacturer's warranty requirements.
 - 2. Provide **6-inch** clearance between adjoining pads.
 - 3. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

- A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.12 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.13 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: Insert name of Owner.
 2. Owner Address: Insert address.
 3. Building Name/Type: Insert information.
 4. Building Address: Insert address.
 5. Area of Work: Insert information.
 6. Acceptance Date: _____.
 7. Warranty Period: Insert time.
 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 55 mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Custom flashing and trim fabrications, made from the following:
 - 1. Sheet metal materials.
 - 2. Underlayment.
 - 3. Miscellaneous materials.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.4 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.5 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 1. Nominal Thickness: 0.028 inch.
 2. Surface: Smooth, flat.
 3. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Color: As selected by Architect from manufacturer's full range.

2.3 UNDERLAYMENT

- A. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.

4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

B. Counterflashing: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

C. Flashing Receivers: Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

E. Roof-Drain Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: 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. Fabricate from the following materials:

1. Galvanized Steel: 0.022 inch thick.

B. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, 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 substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

1. Lap horizontal joints not less than 4 inches.

2. Lap end joints not less than 12 inches.

B. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

C. Install slip sheet, wrinkle free, directly on substrate before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than 4 inches.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of .
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.

2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints where necessary for strength.

3.4 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing:
1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 2. Extend counterflashing 4 inches over base flashing.
 3. Lap counterflashing joints minimum of 4 inches.

4. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL SHEET METAL FABRICATIONS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing:
 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 INSTALLATION TOLERANCES

- A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

- A. Clean and neutralize flux materials. Clean off excess solder.
- B. Clean off excess sealants.

3.9 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION

SECTION 077129

MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum roof expansion joints.

B. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Aluminum roof expansion joints.

B. Shop Drawings: For roof expansion joints.

1. Include plans, elevations, sections, and attachment details.
2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
3. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

C. Samples: For each exposed product and for each color specified, 6 inches in size.

1.3 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof expansion joints that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.

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

2.2 ALUMINUM ROOF EXPANSION JOINTS

- A. Aluminum Roof Expansion Joint: Factory-fabricated, continuous, waterproof, joint cover; consisting of a formed or extruded metal cover secured to extruded aluminum frames, with water-resistant gasketing between cover and frames, and with provision for securing assembly to substrate and sealing assembly to roofing membrane or flashing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: (Basis of Design: Balco 9WC-2 or similar)

- a. Balco; a CSW Industrials Company.

2. Joint Movement Capability: Plus and minus 25 percent of joint size.
3. Frame Members: Extruded aluminum configured as indicated; with exposed finish as selected by Architect from manufacturer's full range.
4. Cover: Formed aluminum; thickness as recommended by manufacturer.
5. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.
6. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the cover.

- B. Materials:

1. Aluminum: ASTM B209 for sheet and plate, ASTM B221 for extrusions; alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
 - b. Mill Finish: As manufactured.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: As recommended by roof-expansion-joint manufacturer.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
 - 1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joint openings, substrates, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions for handling and installing roof expansion joints.
 - 1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
 - 2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 3. Provide for linear thermal expansion of roof-expansion-joint materials.
 - 4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
 - 5. Provide uniform, neat seams.
 - 6. Install roof expansion joints to fit substrates and to result in watertight performance.
- B. Directional Changes: Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.
- C. Transitions to Other Expansion-Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion-control joint assemblies specified in Section 079513.16 "Exterior Expansion Joint Cover Assemblies" to result in watertight performance.
- D. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.
 - 1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.
- E. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

END OF SECTION

SECTION 079216
RIGID JOINT SEALANTS / CONCRETE FLOOR JOINT FILLERS

PART 1 – GENERAL

- 1.01 GENERAL DESCRIPTION OF WORK
- A. Provide all labor, products and equipment required to properly install semi-rigid filler in joints in the interior concrete floor slabs.
- 1.02 SCOPE OF WORK
- A. Fill all contraction (control) and construction (formed) joints in the interior concrete floor slab where the joints will be exposed to material handling vehicle wheels.
 - B. Refer to drawings for additional joints possibly requiring filler, such as joints under racks, joints at column diamonds and pads, etc.
- 1.03 RELATED WORK
- A. Division 3, Section 03 30 00 – “Cast-In-Place Concrete”
 - B. Division 3, Section 03 01 30 – “Concrete Floor Crack and Joint Repair”
 - C. Division 7, Section 07 91 26 – “Joint Fillers”
- 1.04 APPLICABLE STANDARDS
- A. Products and installation shall be in compliance or exceed the joint filling criteria established in the latest ACI 302 and ACI 360 Committee published documents.
- 1.05 CONTRACTOR QUALIFICATIONS
- A. Installer shall have a minimum of three (3) years experience in the installation of semi-rigid fillers on industrial floors.
 - B. Use only Metzger/McGuire Approved Applicators for work covered by this section.
 - C. Approved Applicator shall use tools and equipment specifically designed for the preparation and placement of industrial joint fillers.
- 1.06 SUBMITTALS
- A. Joint Filler Materials: Submit Manufacturer’s data describing joint filler proposed for use on the project.
 - B. Submit Manufacturer’s Approved Applicator Certificate.
 - C. Samples: Cured Samples for each exposed product and for each color and texture specified.
 - D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - a. Provide floor joint filler at area indicated for Polished Concrete Finishing mockup.

PART 2 – PRODUCTS

- 2.01 CONTROL JOINT FILLER:

- A. Provide semi-rigid, two-part, self-leveling, 100% solids content polyurea control and construction joint fillers intended for each condition listed.
- B. Utilize products with physical properties meeting the following minimum values.

PROPERTY	TEST METHOD	PROPERTY VALUE
Shore A Hardness.....	ASTM D2240.....	86 or greater
Tensile Strength.....	ASTM D638.....	970 psi “
Adhesion to Concrete	ASTM D4541.....	350 psi “
Solids Content.....		100%

Acceptable for use in USDA/FDA/CFIA regulated facilities

- C. Products:
 - a. Basis of Design, subject to compliance with requirements, utilize products manufactured by Metzger/McGuire Co., Concord, NH (800) 223-6680.
 - 1. Joint filler for all areas with operating temperatures of 32°F or higher, shall be “SPAL-PRO RS 88 Rapid Set Polyurea Joint Filler”.
 - b. ARDEX Americas.
 - c. ASTC Polymers.
 - d. BASF Corp. - Construction Chemicals.
 - e. ChemCo Systems.
 - f. Euclid Chemical Company (The); an RPM company
 - g. Architect approved equal.
 - h. Substitution Limitations:
 - i. Submit written request for approval of substitutions to the Architect Include the following information:
 - 1. Name of the materials and description of the proposed substitute.
 - 2. Drawings, cut sheets, performance and test data.
 - 3. List of projects similar scope and photographs of existing installations.
 - 4. Other information necessary for evaluation.
 - j. After evaluation by Architect, approval will be issued via addendum. No verbal approval will be given.

D. Color: As selected by Architect from full range of industry colors.

2.02 ACCESSORIES

- A. The use of compressible foam backer rod is strictly prohibited in ALL saw-cut control joints.
- B. Compressible foam backer rod may be used in through slab construction joints only but MUST be placed at a minimum depth of 2”. No other use of backer rod will be allowed. Refer to installation section and product technical data for additional information.

2.03 DUST FREE PREPARATION EQUIPMENT

- A. Subject to compliance with project requirements, provide equipment manufactured by the following:
 - 1. U.S. Saws

2. Gorilla Concrete Tools
3. Pulman-Ermator
4. Diamatic
5. Husqvarna
7. HTC
8. Perfect-Trac
9. Approved Equal

B. DUST EXTRACTION SYSTEM FOR GRINDING/SAWING:

1. HEPA filtration vacuum, designed for use with all hand tools when grinding
sawing concrete (minimum 125CFM air flow).
2. Provide one of the following:
 - a. S26/S36, by Pullman-Ermator
 - b. D30/D60, by HTC
 - c. Approved equal

C. JOINT FILLER REMOVAL AND PREPARATION

1. Dust Buggy (MKIII or Standard) by U.S. Saws
2. GCT-10/X Tank by Gorilla Concrete Tools
3. JS-130/JS-100E by U.S. Saws
4. Perfect-Trac Saw by Perfect-Trac.
5. Approved equal

PART 3 – EXECUTION

3.01 PROJECT CONDITIONS

- A. Work area should be free of obstructions and other trades.
- B. Slab should be visibly dry and all floor scrubbing/washing activities should be suspended at least 48 hours prior to filler installation.

3.02 TIMING OF INSTALLATION

- A. The American Concrete Institute (ACI) recommends that filling be deferred as long as possible to allow for maximum slab shrinkage and joint widening. Deferring filler installation as long as possible will help to minimize the occurrence of joint filler separation due to excessive joint widening during concrete cure (and shrinkage).
- B. For ambient temperatures a 90-120 day slab cure is advisable. Deferring filling until after facility is under permanent temperature control is best, if possible. At a minimum slab cure time should exceed 28 days per ACI 302.
- C. If building is to have HVAC/climate control it is recommended that such system be activated for a minimum of 7 days prior to filler installation.

3.03 EXAMINATION OF CONDITIONS

- A. It is the responsibility of the installer to inspect project and joint conditions and notify on-site management in writing of any deficiencies that might adversely affect the quality or durability of the work performed or his contract price.
- B. Start of work by the installer implies acceptance of conditions.

3.04 PRE-INSTALLATION SAMPLE

- A. Before start of actual work the applicator shall install samples to demonstrate his intended procedures and finished product. Sample shall include at least 25' each of both contraction and construction joints and be performed in the presence of on-site management.
- B. If procedures and finished product are approved they will be considered a standard for the entire project.

3.05 JOINT PREPARATION

- A. Prior to installation of joint fillers, all saw-cut joints shall be thoroughly cleaned to their full original depth. Typically 1 ¼ - 1 ½" in a 6" slab, 2" in an 8" slab. Where the original saw-cut depth exceeds 2", joint preparation and filling must be performed to a minimum depth of 2".
- B. Construction (formed, through slab) joints that are not saw-cut shall be cleaned to a minimum depth of 2".
- C. Preparation shall be performed using a vacuum-equipped saw that will reach the base of the saw-cut joint or to a depth of 2" in the case of through slab construction joints, and shall be used in a manner that takes both joint walls back to bare concrete, removing all saw laitance, curing compounds, sealers, debris, etc. Joint cleaning may be performed using two cleaning passes, one along each side of the joint. Or, if only one cleaning pass is performed, the diamond blade width must be slightly wider than the joint to be cleaned.
- D. Where joints have minor edge chips, said chips shall be "squared off" and filled along with the joint itself.
- E. Keep prepared joints free of dust, moisture, and jobsite debris prior to filling.

3.06 CHOKING-OFF JOINT BOTTOM

- A. Compressible backer rod is prohibited in saw-cut joints unless they exceed 2" deep.
- B. Compressible backer rod may be used in through-slab (non-sawn) construction joints but must be recessed at least 2" below the slab surface. Caution: The use of backer rod in any saw-cut joints less than 2" deep will result in the rejection of all saw-cut joints work.

3.07 JOINT FILLER INSTALLATION

- A. Installation of SPAL-PRO RS 88 Rapid Set Polyurea Joint Filler:

1. Pre-mix Part "A" component (polyol) to re-distribute any settlement that may have occurred during shipping or storage.
2. Because of extremely short pot life, "Spal-Pro RS 88" must be dispensed using dual-component power dispensing equipment or through dual-component cartridge units. Pump, reservoir tanks and dispensing wand should be heated for all freezer work.
3. Fill joint in one pass, from bottom to top, slightly overfilling the joint.
4. After "Spal-Pro RS 88" has fully cured, razor off excess to leave a flush filler profile. Timing of the razoring (30 min. to 1 hour typically) can affect flushness; test for shave time that will result in flush shave.
5. If low spots exist or if the finish profile is not flush, abrade the filler surface with a wire brush, wire wheel, or other means and apply an additional cap bead of RS 88 filler. Allow to cure, and razor flush to the floor surface.

PART 4 -QUALITY ASSURANCE

4.01 JOINT FILLER DEFICIENCIES:

- A. Installer is advised that significant deficiencies in workmanship, including: less than proper filler depth, inadequate joint cleaning, concave filler profile, etc., shall be removed and properly replaced.
- B. Joint filler installed to depths less than specified in this Section shall be removed and replaced at no additional cost to the General Contractor or Owner. As each sector of work is completed the general contractor, using a 1/8" drill bit, shall drill through the filler to verify filler depth. GC shall test drill at an approximate rate of 1 core every 500 lineal feet. Location of core and filler depth found shall be recorded and provided to the owner prior to project completion.

END OF SECTION

**SECTION 081113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware.
- B. Section 088000 - Glazing: Glass for doors and borrowed lites.
- C. Section 099113 - Exterior Painting: Field painting.
- D. Section 099123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SCIF: Sensitive Compartmented Information Facility.
- G. SDI: Steel Door Institute.
- H. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- G. 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; 2023, with Editorial Revision.
- H. 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.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- J. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

- K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- N. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
- O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- P. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.05 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. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 1. Ceco Door, an Assa Abloy Group compan: www.assaabloydss.com/#sle.
 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 3. Deansteel Manufacturing Company, Inc; Hollow Metal Doors - SP Series: www.deansteel.com/#sle.
 4. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 5. Mesker, dormakaba Group; FDJ Series Drywall Frames: www.meskeropeningsgroup.com/#sle.
 6. Premier Steel Doors and Frames; F Series Commercial Frames: www.trustpremier.com/#sle.
 7. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 8. Steelcraft, an Allegion brand: www.allegion.com/#sle.

9. Titan Metal Products, Inc; Builders Series 20 - 90 Minute Doors: www.titanmetalproducts.com/#sle.
10. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 1. Steel Sheet: Comply with one or more of the following requirements; galvanized 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: Manufacturer's standard for application indicated.
 5. Typical Door Face Sheets: Flush.
 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
 7. 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.
 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) 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 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) 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; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Type F Exterior Doors: Thermally insulated.
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
 - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.
 2. Door Core Material: Polyisocyanurate, 2 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 9.9, minimum, for installed thickness of polyisocyanurate.
 4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
 5. Weatherstripping: Refer to Section 087100.
 6. Door Finish: Factory primed and field finished.
- B. Type F Interior Doors, Non-Fire-Rated:
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.

- c. Model 1 - Full Flush.
- d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
- 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
- 3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
- 4. Door Finish: Factory primed and field finished.

2.04 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: Face welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
 - 3. Frame Finish: Factory primed and field finished.
 - 4. Weatherstripping: Separate, see Section 087100.
- C. Interior Door Frames, Non-Fire Rated: Face welded type.
 - 1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
 - 2. Frame Finish: Factory primed and field finished.
- D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- E. Mullions for Pairs of Doors: Removable type, with profile similar to jambs.
- F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- G. Transom Bars: Fixed, of profile same as jamb and head.
- H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.

2.05 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 (0.4 mm) dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
- B. Glazing: As specified in Section 088000, factory installed.
- C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- D. Astragals for Double Doors: Specified in Section 087100.
- E. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- F. Silencers: Resilient rubber, 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.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 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.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 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. Coordinate frame anchor placement with wall construction.
- C. 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.
- D. Comply with glazing installation requirements of Section 088000.
- E. Coordinate installation of electrical connections to electrical hardware items.
- F. Touch up damaged factory finishes.

3.04 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 (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.

3.06 SCHEDULE - SEE DRAWINGS

- A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

**SECTION 081416
FLUSH WOOD DOORS**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors with plastic-laminate-faces.
2. Real wood veneer to match new doors in existing building.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 087100 "Door Hardware" for hardware used with flush wood doors.
2. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

10. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For plastic-laminate door faces polymer edging.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.
3. Polymer edging, in manufacturer's standard colors.
4. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
5. Louver blade and frame sections, 6 inches long, for each material and finish specified.
6. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

2. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
 3. Warranty Period for Solid-Core Exterior Doors: Two years from date of Substantial Completion.
 4. Warranty Period for Solid-Core Interior Doors: Life of installation.
 5. Warranty Period for Hollow-Core Interior Doors: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flush wood doors and wood paneling from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with UL 10C.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. Interior Doors, Solid Core :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Masonite Architectural.
 - b. Oshkosh Door Company.
 - c. VT Industries Inc.
2. Performance Grade by Location:
 - a. ANSI/WDMA I.S. 1A Extra Heavy Duty: Classrooms public toilets janitor's closets assembly spaces exits and where indicated on Drawings.
 - b. ANSI/WDMA I.S. 1A Standard Duty: Closets (not including janitor's closets) private toilets.
3. Architectural Woodwork Standards Grade: Premium.
4. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
5. Class A fire-rated laminate at 90-minute doors.
6. Colors, Patterns, and Finishes: As indicated on Drawings.
7. Exposed Vertical and Top Edges: impact-resistant polymer edging, applied after faces.
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors:
 - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.
8. Core for Non-Fire-Rated Doors:
 - a. ANSI A208.1, Grade LD-2 particleboard.
9. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c. 5-inch midrail blocking, in doors indicated to have exit devices.

- 1) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."
10. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 11. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
 - a. 5-inch top-rail blocking.
 - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch midrail blocking, in doors indicated to have armor plates.
 - d. 5-inch midrail blocking, in doors indicated to have exit devices.
 12. Construction:
 - a. Three plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces are applied.
- 2.4 Wood Veneer Doors (match doors located in existing NECE building).
1. White Maple Plain Sliced, Book and Running Match, Grade "A" Veneer.
- 2.5 LIGHT FRAMES AND LOUVERS
- A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.
- 2.6 FABRICATION
- A. Factory fit doors to suit frame-opening sizes indicated.
 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 2. Comply with NFPA 80 requirements for fire-rated doors.
 - B. Factory machine doors for hardware that is not surface applied.
 1. Locate hardware to comply with DHI-WDHS-3.
 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
 - C. Transom and Side Panels:

1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
 2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 3. Fabricate door and transom panels with full-width, solid-lumber[, **rabbeted**,] meeting rails.
 4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
 3. Louvers: Factory install louvers in prepared openings.
- E. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory finishing.
1. Flash top of outswinging doors with manufacturer's standard metal flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1) For factory-finished items, use filler matching finish of items being installed.
 3. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:
 - a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
 - b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
 - c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
 - d. Comply with NFPA 80 for fire-rated doors.
5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083613
SECTIONAL DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sectional-door assemblies.
- B. Related Requirements:
 - 1. Section 099113 "Exterior Painting" for finish painting of factory-primed steel doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.
- D. Samples for Verification: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:
 - 1. Glazing.
 - 2. Metal for door sections.
 - 3. Hardware.
 - 4. .

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For manufacturer's warranty and finish warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.
- B. Manufacturer's warranty.
- C. Finish warranty.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with provisions in the U.S. Department of Justice's "2010 ADA Standards for Accessible Design" applicable to sectional doors.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.

1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 1. Design Wind Load: As indicated on Drawings.
 2. Testing: In accordance with ASTM E330/E330M.
 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.
 4. Operability under Wind Load: Design sectional doors to remain operable under design wind load, acting inward and outward.
- C. Windborne-Debris Impact Resistance: Provide sectional doors complying with the following requirements:
 1. Glazed Openings: Pass ASTM E1886 Large Missile Test and cyclic-pressure tests in accordance with ASTM E1996 for basic protection and Wind Zone applicable to basic design wind speed indicated on Drawings.
 2. Garage-Door Glazed Openings: Pass DASMA 115.

2.3 SECTIONAL-DOOR ASSEMBLY

- A. Steel Sectional Door: Provide sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Clopay Building Products.
 - b. Overhead Door Corporation.
 - c. Raynor.
- B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. (2.03 L/s per sq. m) when tested in accordance with ASTM E283 or DASMA 105.
- D. U-Value: 0.052 Btu/sq. ft. x h x deg F (0.295 W/sq. m x K) Insert value.

- E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with G60 (Z180) zinc coating.
1. Door-Section Thickness: 2 inches (51 mm).
 2. Section Faces:
 - a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
 - b. Exterior Face: Fabricated from single sheets, not more than 24 inches (610 mm) high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Steel Sheet Thickness: 0.028-inch (0.71-mm) nominal coated thickness.
 - 2) Surface: Manufacturer's standard, grooved wood-grain embossed. Horizontal plank type.
 - c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
 - 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of 0.022 inch (0.56 mm).
 3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.040-inch (1.02-mm) nominal coated thickness and welded to door section.
 4. Intermediate Stiles: Provide intermediate stiles formed from not less than 0.040-inch-(1.02-mm-) thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches (1219 mm) apart.
 5. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
 - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile and allowing installation of astragal (weatherseal).
 - b. Hardware Locations: Provide reinforcement for hardware attachment.
 6. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free insulation of type indicated below:
 - a. Board Insulation: polyurethane, secured to exterior face sheet.
- F. Track: Manufacturer's standard, galvanized-steel, standard-lift track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 (Z180) zinc coating.
 2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device.

- a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle attached to track and wall.
 - b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

- G. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door. Provide combination bottom weatherseal and sensor edge for bottom seal.

- H. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing: At exterior overhead door only.
 - 1. Insulating Glass Units: Manufacturer's standard.

- I. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
 - 1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch (2.01-mm) nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
 - a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
 - b. Provide double-end hinges where required for doors more than 16 ft. (4.88 m) wide unless otherwise recommended by door manufacturer in writing.
 - 2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - a. Roller-Tire Material: Manufacturer's standard.
 - 3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.
 - 4. .

- J. Locking Device:
 - 1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

- K. Counterbalance Mechanism:
 - 1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
 - 2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.

- b. Provide one additional midpoint bracket for shafts up to 16 ft. (4.88 m) long and two additional brackets at one-third points to support shafts more than 16 ft. (4.88 m) long unless closer spacing is recommended in writing by door manufacturer.
 - 3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
 - 4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
 - 5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
 - 6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
 - 7. .
- L. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
 - 3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use.
 - 4. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
 - 5. Operator Type: Jackshaft, side mounted.
 - 6. Motor: Reversible-type for interior, clean, and dry motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
 - a. Motor Size: As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
 - b. Electrical Characteristics:
 - 1) Phase: Single phase.
 - 2) Volts: 115 V.
 - 7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 - 8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Monitored Entrapment Protection: Photoelectric sensor Electric sensor edge on bottom section designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 - 9. Control Station: Surface mounted, three-position (open, close, and stop) control.
 - a. Operation: Push button.
 - b. Interior-Mounted Unit: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

c. Features: Provide the following:

1) .

10. Emergency Manual Operation: Chain type designed so required force for door operation does not exceed 25 lbf (111 N).
11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

M. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range; Basis of Design: Charcoal Gray..

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches (610 mm) apart.
 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

- D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION

SECTION 084113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Aluminum-framed entrance and storefront systems.

B. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
6. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrance and storefront systems.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 - 3. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 - 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
- G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 - b. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.26 as determined in accordance with NFRC 200.
 - b. Entrance Doors: SHGC of not more than 0.22 as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of when tested in accordance with ASTM E283.
 - b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined in accordance with AAMA 1503.
 - b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: -20 deg F.
 - c. Interior Ambient-Air Temperature: 75 deg F.

2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Boyd Aluminum Mfg. Co.
2. CMI Architectural Products, Inc.
3. Coral Architectural Products; Coral Industries, Inc.
4. EFCO Corporation.
5. Kawneer Company, Inc.; Arconic Corporation.
6. Manko Window Systems, Inc.
7. OldCastle BuildingEnvelope (OBE).
8. Trulite Glass & Aluminum Solutions, LLC.
9. Tubelite Inc.
10. U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.
11. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
4. Finish: Match adjacent storefront framing finish.

2.4 ENTRANCE DOOR HARDWARE

2.5 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

2.6 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, fabricated from 300 series stainless steel.
- B. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from exterior.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Fabricate components for assembly using shear-block system.
- F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.

- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

- K. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- L. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- M. Install glazing as specified in Section 088000 "Glazing."
- N. Install structural glazing as follows:
 - 1. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 2. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
 - 3. Set glazing with proper orientation so that coatings face exterior or interior as specified.
 - 4. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
 - 5. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.
 - 6. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
 - 7. Allow structural sealant to cure in accordance with manufacturer's written instructions.
 - 8. Clean and protect glass as indicated in Section 088000 "Glazing."
 - 9. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
 - 10. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

END OF SECTION

**SECTION 085113
ALUMINUM WINDOWS**

PART 2 PRODUCTS

1.01 ALUMINUM WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
1. Frame Depth: 4 1/2"
 2. Finish: Clear Anodized
 3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
 4. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 5. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

END OF SECTION

**SECTION 08 71 00
DOOR HARDWARE**

PART 1 - GENERAL

1.1 CONDITIONS

- A. Conditions of the contract (General and Supplementary Conditions) and Division 01 - General Requirements, govern the work of this section.
- B. This section includes all material and related service necessary to furnish all finish hardware indicated on the drawings or specified herein.
- C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.
- D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

1.2 WORK INCLUDED

- A. This section includes the following:
 - 1. Furnish door hardware specified herein, listed in the hardware schedule, and/or required by the drawings.
 - 2. Cylinders for Aluminum Doors
 - 3. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
 - 4. Electro-Mechanical Devices
- B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

1.3 RELATED WORK IN OTHER SECTIONS

- A. This section includes coordination with related work in the following sections:
 - 1. Division 06 Section "Finish Carpentry".
 - 2. Division 08 Section "Hollow Metal Doors and Frames".
 - 3. Division 08 Section "Wood Doors"
 - 4. Division 08 Section "Aluminum Entrances and Storefronts"
 - 5. Division 26 Section "Electrical"
 - 6. Division 28 Section "Electronic Safety and Security".

1.4 REFERENCES

- A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.
 - 1. DHI - Recommended Locations for Builders' Hardware.
 - 2. NFPA 80 - Standards for Fire Doors and Windows.
 - 3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
 - 4. UL - Building Material Directory.
 - 5. DHI - Door and Hardware Institute
 - 6. WHI - Warnock Hersey
 - 7. BHMA - Builders Hardware Manufacturers Association
 - 8. ANSI - American National Standards Institute
 - 9. IBC- International Building Code (as adopted and amended by local building code)

1.5 SUBMITTALS

- A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 01 - General Requirements.

- B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:
1. Door number, location, size, handing, and rating.
 2. Door and frame material, handing.
 3. Degree of swing.
 4. Manufacturer
 5. Product name and catalog number
 6. Function, type and style
 7. Size and finish of each item
 8. Mounting heights
 9. Explanation of abbreviations, symbols, etc.
 10. Numerical door index, indicating the hardware set/ group number for each door.
- C. When universal type door closers are to be provided, the schedule shall indicate the application method to be used for installation at each door: (regular arm, parallel arm, or top jamb).
- D. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC), or certified Door Hardware Consultant (DHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed or stamped with the DHI certification seal of the supervising AHC or DHC. The supervising AHC or DHC shall attend any meetings related to the project when requested by the architect.
- E. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.
- F. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or incompatible items, and proposed substitutions in the hardware schedule.
- G. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.
- H. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 01 - General Requirements.
- I. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.
- J. Furnish with first submittal, a list of required lead times for all hardware items.
- K. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 01 - General Requirements.
- L. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.
- M. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electro-mechanical devices or systems as required by related trades. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.
- N. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and field use in quantities as required by Division 01 - General Requirements. Wiring diagrams shall be included in final submittals transmitted for distribution of field use.

1.6 QUALITY ASSURANCE

- A. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division 01 - General Requirements.
- B. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the architect.
- C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to ensure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.
- E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.
- F. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years' experience in successful completion of projects similar in size and scope.
- G. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.
- H. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.
- I. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.
- B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.
- C. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receipt of material at the job site.
- D. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

1.8 PRE-INSTALLATION MEETING

- A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.

- B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturer's representatives for above hardware items, and any other affected subcontractors or suppliers.
- C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

1.9 WARRANTY

- A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division 01 - General Requirements.
- B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

PART 2 - PRODUCTS

2.1 FASTENERS

- A. All exposed fasteners shall be Phillips head or as otherwise specified and shall match the finish of the adjacent hardware. All fasteners exposed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.
- B. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

2.2 BUTT HINGES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Stanley</u>	<u>Hager</u>	<u>McKinney</u>
1. Standard Weight, Plain Bearing	5PB1	F179	****	T2714
2. Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714
3. Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
4. Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
5. Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

- B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.1 (2006). Hinges shall meet or exceed the following ANSI grade requirements as indicated below:
 - 1. Standard Weight, Plain Bearing Hinges: Grade 3
 - 2. Standard Weight, 2 Ball Bearing Hinges: Grade 2
 - 3. Heavy Weight, 4 Ball Bearing Hinges: Grade 1
- C. Unless otherwise specified, furnish the following hinge quantities for each door leaf.
 - 1. 3 hinges for doors up to 90 inches.
 - 2. 1 additional hinge for every 30 inches on doors over 90 inches.
 - 3. 4 hinges for Dutch door applications.
- D. Unless otherwise specified, top and bottom hinges shall be located as specified in Division 08 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.
- E. Unless otherwise specified, furnish hinge weight and type as follows:
 - 1. Standard weight: plain bearing hinge 5PB1 or ball bearing hinge 5BB1 for interior openings through 36 inches wide without a door closer.
 - 2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.
 - 3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
 - 4. Heavyweight: 4 ball bearing hinge 5BB1HWSS for exterior openings unless otherwise listed in groups.

- 5. Heavyweight: 4 ball bearing hinge 5BB1HWSS 5" for all exterior doors or 4 ball bearing hinge 5BB1HW 5" for interior doors, that have an automatic operator.
- F. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
- G. Unless otherwise specified, furnish hinges in the following sizes:
 - 1. 5" x 5" 2-1/4" thick doors
 - 2. 4-1/2" x 4-1/2" 1-3/4" thick doors
 - 3. 3-1/2" x 3-1/2" 1-3/8" thick doors
- H. Furnish hinges with width to accommodate trim and allow for 180-degree swing.
- I. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins. Furnish non-removable pin (NRP) hinges at all reverse-handed doors that are furnished with lockable hardware.
- J. Unless otherwise specified, furnish all hinges to template standards.

2.3 EXIT DEVICES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Von Duprin</u>	<u>Falcon</u>	<u>Corbin</u>
1. Wide Stile, Push Pad	78 Series	25 Series	ED5000-M110 Series
2. Lever Trim	780 Series	510L / 511L Series	900 Series
3. Pull Trim	785 Series	512 Series	1300 Series

- A. Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3, Grade 1 (2008).
- B. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
- C. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.
- D. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.
- E. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.
- F. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)
- G. All exit devices shall be provided with trim designs to match other lever and pull designs used on the project.
- H. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
- I. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
- J. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

2.4 LOCKS AND LATCHES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Schlage</u>	<u>Falcon</u>	<u>Corbin</u>
1. Grade 1 Mortise	L Series M81	MA Series BOG	ML2000 123
2. Grade 1 Cylindrical	ND Series BRK	T Series BRK	CLX3300 123

- B. Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2011).
- C. Mortise locks shall be independently certified by ANSI for compliance with ANSI A156.13 (2012).
- D. Provide full narrow escutcheon at mortise locks with indicators.
- E. Unless otherwise specified, all locks and latches to have:
 - 1. 2-3/4" Backset
 - 2. 1/2" minimum throw latchbolt
 - 3. 1" throw deadbolt
 - 4. ANSI A115.2 strikes
- F. Provide guarded latch bolts for all locksets, and latch bolts with throw to maintain fire rating of both single and paired door assemblies.
- G. Provide strike with lip length adequate to clear surrounding trim.
- H. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.
- I. Provide temperature control modules for electrified locks to limit transfer of heat to door lever.

2.5 PULLS, PUSH BARS, PUSH/PULL PLATES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Burns</u>	<u>Hager</u>
1. Pull / Push-Bar (1" dia., 10" CTC Pull)	9103-0	422 x 26C	153
2. Offset Door Pull (1" dia., 10" CTC)	8190-0	39C	12J
3. Offset Pull / Push-Bar (1" dia., 10" CTC Pull)	9190-0	422 x 39C	159

- A. Adjust dimensions of push plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, push plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled 4 sides and counter sunk.
- B. When mounting straight pull on a wide stile door will prevent access to key cylinder, mount pull offset from cylinder location to allow access to cylinder.
- C. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

2.6 CLOSERS

- A. Acceptable manufacturers and respective catalog numbers:

<u>LCN</u>	<u>Falcon</u>	<u>Norton</u>
1. 4050A / 4050A EDA	SC70A/SC70A FA HD	R7500 / PR7500

- B. Door closers shall be independently certified by ANSI for compliance with ANSI A156.4, Grade 1 (2013).
- C. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Provide extra heavy-duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
- E. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.
- F. Closers shall use aluminum cylinders.
- G. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.

- H. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
- I. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
- J. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.
- K. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
- L. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.

2.7 LOW ENERGY ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

- A. Acceptable manufacturers and respective catalog numbers:
 - 1. Electro-Hydraulic Operator

<u>LCN</u>
4640
- B. Low energy operators shall be independently certified by ANSI for compliance with ANSI A156.19 (2002).
- C. Where low kinetic energy, as defined by ANSI/BHMA Standard A156.19, power operators are indicated for doors required to be accessible to the disabled, provide electrically powered operators complying with the ADA for opening force and time to close standards.
- D. The closing action shall be controlled by modern type cast iron door closer cylinder filled with a flat viscosity fluid, stable from +120F to -30F that would require no seasonal adjustments. The closer shall have field adjustable spring power; have two independent closing speed adjustment valves, and hydraulic back-check.
- E. Full closing force shall be provided when the power or assist cycle ends.
- F. All power operator systems shall include the following features and functions:
 - 1. Provisions for separate conduits to carry high and low voltage wiring in compliance with the National Electrical Code, section 725-31.
 - 2. The operator will be designed with an electronically controlled mechanical clutching mechanism to prevent damage to the operator if the system is actuated while the door is latched or if the door is forced closed during the opening cycle.
 - 3. All covers, mounting plates and arm systems shall be powder coated and successfully pass a minimum of 100 hours testing as outlined in ANSI/BHMA Standard A156.18.
 - 4. UL listed for use on labeled doors.
 - 5. All operators shall be non-handed with spring power over a range of at least four sizes; either 1 through 4 or 2 through 5.
 - 6. The power operator shall incorporate microprocessor controlled digital controls including factory default memory settings, on-board diagnostics, non-volatile memory, and integrated delay and relay for controlling door release devices.
 - 7. Provisions in the control box or module shall provide control {inputs and outputs} for; electric strike delay, auxiliary contacts, sequential operation, fire alarms systems, actuators, swing side sensors, and stop side sensors.
 - 8. Exterior actuator switches shall be weather resistant and mount on a single gang electrical box furnished by Division 26.
- G. All electrically powered operators shall include the following features or functions:
 - 1. When an obstruction or resistance to the opening swing is encountered, the operator will pause at that point, then attempt to continue opening the door. If the obstruction or resistance remains, the operator will again pause the door.

2. Easily accessible main power and maintain hold open switches will be provided on the operator.
 3. An electronically controlled clutch to provide adjustable opening force.
 4. A microprocessor to control all motor and clutch functions.
 5. An on-board power supply capable of delivering both 12V and 24V outputs up to a maximum of 1.0 ampere combined load.
 6. All input and output power wiring shall be protected by slow blow fuses. These fuses shall be easily replaceable without special tools or component replacement.
 7. If electrical failure occurs, the unit shall operate as a standard door closer.
- H. Power Operators shall be warranted by the manufacture to be free from defects in material and workmanship for a period of two years.

2.8 KICK PLATES AND MOP PLATES

- A. Furnish protective plates as specified in hardware groups.
- B. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.
- C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk.
- D. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing. When protection plates over 16" are provided for labeled doors, the plate shall be labeled.
- E. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
- F. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

2.9 OVERHEAD STOPS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Glynn-Johnson</u>	<u>Rixson</u>	<u>Sargent</u>
1. Heavy Duty Surface Mount	GJ900 Series	9 Series	590
2. Heavy Duty Concealed Mount	GJ100 Series	1 Series	690
- B. Unless otherwise specified, furnish GJ900 series overhead stop for hollow metal or 1-3/4" solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4" solid core doors that open against equipment, casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.
- C. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.
- D. Provide special stop only ("SE" suffix) overhead stops when used in conjunction with electronic hold open closers.
- E. Do not provide holder function for labeled doors.

2.10 WALL STOPS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Hager</u>	<u>Burns</u>
1. Wrought Convex Wall Stop	WS406CVX	232W	570
2. Wrought Concave Wall Stop	WS406CCV	236W	575
- B. Furnish a stop or holder for all doors.

- C. Provide concave style wall stop at all adjacent integral push button locks; provide convex style wall stop at all other locations.
- D. Where wall stops are not applicable, furnish overhead stops.
- E. Furnish floor stops only where specified in hardware sets.
- F. Do not provide holder function for labeled doors.

2.11 WEATHERSTRIP, GASKETING

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
1. Weatherstrip	429	2891_PK	700NA	755
2. Adhesive Gasket	188	S88	5050	797
3. Mullion Seal/Silencer	8780	5110	5100N	***
4. Meeting Edge Seals	8193	18041	9605	959
5. Sweep (Brush)	8192	18061_NB	B606	964
6. Sweep w/ drip	8198	345_N	C627	354
7. Drip Cap	142	346	16	R201

- B. Weatherstrip and gasketing shall be independently certified by ANSI for compliance with ANSI A156.22 (2005).
- C. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.
- D. Provide weatherstripping all exterior doors and where specified in hardware sets.
- E. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.
- F. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.
- G. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

2.12 THRESHOLDS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
1. Saddle Threshold	8655	171	425	S205
2. Half Saddle Threshold	1675	****	325	S245
3. Saddle Threshold (Inswing)	653	169	****	****
4. Saddle Threshold (Interior)	63	151	411	S263

- A. Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2001).
- B. Hardware supplier shall verify finish floor conditions and provide proper threshold as required to provide a smooth transition between finished floor surfaces.
- C. Unless otherwise specified or detailed, provide threshold as follows:
 - 1. Provide Zero 8655 or similar saddle threshold for exterior openings with finished floor height transition of 1/4" or less.
 - 2. Provide Zero 1675 or similar half-saddle threshold for exterior openings with finished floor height transition of 1/4" to 1/2".
 - 3. Provide Zero 653 or similar narrow saddle threshold for exterior doors that swing into the building.
 - 4. Provide Zero 63 or similar low-rise saddle threshold for interior openings when specified with a door sweep or automatic door bottom.

2.13 ELECTRIC STRIKES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Von Duprin</u>	<u>HES</u>
1. Type 1	6200 Series	4500 Series
2. Type 2	6300 Series	9500 Series

- B. Provide electric strikes compatible with the type of locks shown at each opening where specified.
- C. Electric strikes shall be UL listed as Burglary-Resistant Electric Door Strikes and where required shall be UL listed as Electric Strike for Fire Doors.
- D. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.14 FINISHES AND BASE MATERIALS

- A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

<u>HARDWARE ITEM</u>	<u>BHMA FINISH</u>
1. Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
2. Butt Hinges: Interior	652 (US26D - Satin Chromium)
3. Exit Devices	626 (US26D - Satin Chromium)
4. Locks and Latches	626 (US26D - Satin Chromium)
5. Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
6. Closers	689 (Powder Coat Aluminum)
7. Protective Plates	630 (US32D - Satin Stainless Steel)
8. Overhead Stops	630 (US32D - Satin Stainless Steel)
9. Wall Stops	630 (US32D - Satin Stainless Steel)
10. Thresholds	719 (Mill Aluminum)
11. Weather-strip, Sweeps Drip Caps	Aluminum Anodized
12. Miscellaneous	626 (US26D - Satin Chromium)

2.15 KEYING

- A. Provide all cylinders in keyways as required to accommodate owners existing key system.
- B. All locks under this section shall be keyed as directed by the owner to an existing Master Key System.
- C. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.
- D. Master keys, control keys, and change keys shall be delivered by registered mail to the owner. Construction keys shall be delivered to the contractor.

2.16 KEY CABINETS

- A. Acceptable manufacturers and respective catalog numbers:

<u>Lund</u>	<u>Key Control</u>	<u>Telkee</u>
1. 1200-1205 AA	M228-2480	RWC-AWC
- B. Furnish 1 each model 1200 or 1205 AA key cabinet with a capacity 1.5 times the number of key sets.
- C. Provide one key cabinet with at least one hook for each key set, plus additional hooks for 50% expansion.
- D. Furnish key cabinet complete with cam lock, permanent key tags, and change key cards.
- E. Hardware supplier shall prepare all key change index records, tag all keys and place permanent file keys in cabinet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to installation of hardware, installer shall examine door frame installation to ensure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

3.2 INSTALLATION

- A. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.
- B. Provide blocking or reinforcement for all hardware mounted to drywall construction, including wall mounted door stops and holders.
- C. Shim doors as required to maintain proper operating clearance between door and frame.
- D. Install all hardware in accordance with the approved hardware schedule and manufacturer's instructions for installation and adjustment.
- E. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.
- G. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.
- H. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.
- I. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.
- J. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.
- K. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.
- L. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.
- M. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.
- N. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.
- O. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.
- P. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.
- Q. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.

- R. Adjust spring power of door closers to the minimum force required to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to ensure opening force does not to exceed 5 lbs.
- S. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.
- T. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel arm door closers, exit devices, etc., as required to accommodate weatherstripping.
- U. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.
- V. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water-resistant seal.
- W. Deliver to the owner one complete set of installation and adjustment instructions, and tools as furnished with the hardware.

3.3 FIELD QUALITY CONTROL

- A. After installation has been completed, the hardware supplier for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.
- B. After installation has been completed, the hardware supplier and manufacturer's representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

3.4 ADJUSTMENT AND CLEANING

- A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. Lubricate moving parts with type lubrication recommended by the manufacturer.
- B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

3.5 HARDWARE SCHEDULE

- A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

HW SET: 01

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50	SCH
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER GASKET	188S	ZER

FUNCTION: (F82) OFFICE LOCK. OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY. INSIDE BUTTON LOCKS OUTSIDE LEVER UNTIL UNLOCKED BY OUTSIDE KEY OR BY TURNING INSIDE LEVER. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 02

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	KEYED PRIVACY LOCK	ND52 OS-OCC	SCH
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER GASKET	188S	ZER

FUNCTION: KEYED PRIVACY LOCK (OFFICE LOCK W/RESTORING LATCH). OUTSIDE LEVER LOCKED/UNLOCKED BY OUTSIDE KEY. INSIDE BUTTON LOCKS OUTSIDE LEVER UNTIL UNLOCKED BY OUTSIDE KEY, TURNING INSIDE LEVER, OR CLOSING DOOR. INSIDE LEVER ALWAYS UNLOCKED. OUTSIDE INDICATOR DISPLAYS LOCKED/UNLOCKED STATUS.

HW SET: 03

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	CLASSROOM LOCK	ND70	SCH
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER GASKET	188S	ZER

FUNCTION: (F84) CLASSROOM LOCK. LATCH RETRACTED BY LEVER EITHER SIDE. OUTSIDE KEY LOCKS/UNLOCKS OUTSIDE LEVER. INSIDE LEVER ALWAYS UNLOCKED.

HW SET: 04

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HARDWARE	BY DOOR SUPPLIER	B/O

HW SET: 05

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	ND80	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	VON
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	EA	PERIMETER GASKET	188S	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	POWER SUPPLY	BY SECURITY SUPPLIER	
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: (F86) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED. ELECTRIC STRIKE UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 06

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	ND80	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	VON
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	WALL STOP	WS406	IVE
1	SET	GASKETING	429 (MOUNT PRIOR TO CLOSER)	ZER
1	EA	DOOR SWEEP	8192	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	POWER SUPPLY	BY SECURITY SUPPLIER	
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: (F86) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED. ELECTRIC STRIKE UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 07

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	STOREROOM LOCK	L9080	SCH
1	EA	ELECTRIC STRIKE	6211 FSE	VON
1	EA	LOCK GUARD	LG14	IVE
1	EA	SURFACE CLOSER	4050A SCUSH	LCN
1	EA	KICK PLATE	8400 10"	IVE
1	EA	RAIN DRIP	142	ZER
1	SET	GASKETING	429	ZER
			(MOUNT PRIOR TO CLOSER)	
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	POWER SUPPLY	BY SECURITY SUPPLIER	
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: (F86) STOREROOM LOCK. FIXED OUTSIDE TRIM - OUTSIDE KEY OR INSIDE LEVER RETRACTS LATCH. INSIDE LEVER ALWAYS UNLOCKED. ELECTRIC STRIKE UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 08

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	PANIC HARDWARE	LD-78-NL-OP	VON
1	EA	ELECTRIC STRIKE	6300 FSE	VON
1	EA	90 DEG OFFSET PULL	8190 10"	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	POWER SUPPLY	BY SECURITY SUPPLIER	
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS. ELECTRIC STRIKE UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION. OUTSIDE PUSH PLATE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE ELECTRIC STRIKE IS UNLOCKED. INSIDE PUSH PLATE ACTUATOR UNLOCKS ELECTRIC STRIKE AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 09

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	PANIC HARDWARE	LD-78-NL-OP	VON
1	EA	ELECTRIC STRIKE	6300 FSE	VON
1	EA	90 DEG OFFSET PULL	8190 10"	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	POWER SUPPLY	BY SECURITY SUPPLIER	
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS. ELECTRIC STRIKE UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION. OUTSIDE PUSH PLATE ACTUATOR AUTOMATICALLY OPENS DOOR ONLY WHILE ELECTRIC STRIKE IS UNLOCKED. INSIDE PUSH PLATE ACTUATOR UNLOCKS ELECTRIC STRIKE AND AUTOMATICALLY OPENS DOOR AT ALL TIMES.

HW SET: 10

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	IC CYLINDER	AS REQUIRED	SCH
1	EA	PANIC HARDWARE	LD-78-NL-OP	VON
1	EA	ELECTRIC STRIKE	6300 FSE	VON
1	EA	90 DEG OFFSET PULL	8190 10"	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURFACE CLOSER	4050A / 4050A EDA	LCN
1	EA	RAIN DRIP	142	ZER
1	EA	WEATHERSTRIPPING	BY DOOR SUPPLIER	B/O
1	EA	DOOR SWEEP	8198	ZER
1	EA	THRESHOLD	AS REQUIRED	ZER
1	EA	CREDENTIAL READER	BY SECURITY SUPPLIER	B/O
1	EA	POWER SUPPLY	BY SECURITY SUPPLIER	
1	EA	WIRING DIAGRAMS	RISER AND POINT-TO-POINT	

FUNCTION: NIGHT LATCH PANIC HARDWARE. FIXED OUTSIDE TRIM - LATCH RETRACTED BY KEY. INSIDE PUSH PAD RETRACTS LATCH FOR EGRESS. ELECTRIC STRIKE UNLOCKED BY ELECTRONIC ACCESS CONTROL SYSTEM FOR PUSH/PULL OPERATION.

HW SET: 11

QTY		DESCRIPTION	CATALOG NUMBER	MFR
	EA	HINGE	AS REQUIRED	IVE
1	EA	PUSH/PULL BAR	9190 10"	IVE
1	EA	OH STOP	100S	GLY
1	EA	SURF. AUTO OPERATOR	4642	LCN
2	EA	ACTUATOR, WALL OR JAMB MOUNT	8310-853 OR 8310-818 AS REQD (VERIFY TYPE AND MOUNTING LOCATION)	LCN

FUNCTION: PUSH/PULL. INSIDE OR OUTSIDE ACTUATOR AUTOMATICALLY OPENS DOOR.

END OF SECTION

**SECTION 088000
GLAZING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 084423 "Structural-Sealant-Glazed Curtain Walls" for glazing sealants used in structural-sealant-glazed curtain walls.
2. Section 088300 "Mirrors."
3. Section 08 8800 Special Function Glazing
4. Section 01 2300 Alternates

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
 1. Tinted glass.
 2. Coated glass.
 3. Laminated glass.
 4. Insulating glass.
 5. Spandrel glass.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer manufacturers of fabricated glass units.
- B. Product Certificates: For glass.
- C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent within specified warranty period. Coverage for any other cause is excluded.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.

- a. Wind Design Data: As indicated on Drawings.
 - b. Basic Wind Speed: 121 MPH.
 - c. Importance Factor: 1.0.
 - d. Exposure Category: C.
- 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- ~~D. Windborne Debris Impact Resistance: Exterior glazing shall pass ASTM E1886 missile impact and cyclic pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.~~
- ~~1. Large Missile Test: For glazing located within 30 feet of grade.~~
 - ~~2. Small Missile Test: For glazing located between 30 feet and 60 feet above grade.~~
- E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
 - F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 - 5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 - 6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.
 - G. Acoustic Performance:
 - 1. Exterior Glazing: 28 OITC.
 - 2. Interior Glazing: 33 STC.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Low-Iron Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and SHGC of not less than 0.87.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGC Glass Company North America, Inc.
 - b. Guardian Glass; SunGuard.
 - c. Vitro Architectural Glass.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- C. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- D. Silicone-Coated Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ICD High Performance Coatings.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Eastman Chemical Company.
 - b. Kuraray America, Inc.
 - 2. Construction: Laminate glass with to comply with interlayer manufacturer's written instructions.
 - 3. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 4. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
 - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction Aluminum with black, color anodic finish.
 - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc.
 - b. Pecora Corporation.

- c. Sika Corporation.
 - d. The Dow Chemical Company.
 - e. Tremco Incorporated.
- C. Acid-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc.
 - b. Pecora Corporation.
 - c. Sika Corporation.
 - d. The Dow Chemical Company.
 - e. Tremco Incorporated.

2.8 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. EPDM with Shore A durometer hardness of 85, plus or minus 5.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:

1. EPDM with Shore A durometer hardness per manufacturer's written instructions.
 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 2. Presence and functioning of weep systems.
 3. Minimum required face and edge clearances.
 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than **50 inches**.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide **1/8-inch**- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 INSULATING GLASS SCHEDULE

- 1. (GL-1) 1" INSULATED TINTED GLASS: Base Bid 1" OA, ¼" Solarblue AN, ½" Spacer ¼" Energy Advantage #4 AN.

Solar Control Low-E Tinted Insulating Glass

"Solarban®" 60 (2) "Solarblue®" + Clear by Vitro Architectural Glass

Outdoor Lite: "Solarblue®" Glass by Vitro Architectural Glass, Sputter Coated on second surface (2)

Indoor Lite: (Pilkington North America) Eclipse Advantage™ Clear

Low-E Coating: "Solarban®" 60 Solar Control (Sputtered) by Vitro Architectural Glass

Coating Location: Second Surface (2)

Performance Values

Visible Light Transmittance 34%. U-Value Winter 0.20. U-Value Summer 0.18. SHGC Shading Coefficient 0.23. Outdoor Visible Light Reflectance 11%.

Approved Manufacturers: Vitro Certified™ Fabricator Required

Outdoor Appearance: Light sky-blue

Insulating Unit Construction: Solarban® 60 on Solarblue® 6mm (2) (Vitro Architectural Glass) | Air (5%) / Argon (95%) Mix 1/2" (12.7mm) | 6mm Eclipse Advantage™ Clear(4) (EclAdvClr6.LOF) (Pilkington North America).

END OF SECTION

**SECTION 092116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.
- H. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 072100 - Thermal Insulation: Acoustic insulation.
- D. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- E. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- F. Section 092216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.
- C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- 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.
- I. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- J. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- K. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- L. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- M. 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.

- N. 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.
- O. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- P. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- Q. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.
- R. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, with Editorial Revision (2020).
- S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- T. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- U. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- V. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
- W. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

1.04 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.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
 - 2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- D. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, indicating finish color and texture.
- E. Steel Framing Industry Association (SFIA) Certification:
 - 1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.
- F. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.
- G. SSFSA Manufacturer Qualification: Submit documentation of manufacturer association membership.
- H. SSMA Manufacturer Qualification: Submit documentation of manufacturer association membership.
- I. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

- B. SFIA Code Compliance Certification Program: www.CFSteel.org/#sle: Use metal studs and connectors certified for compliance with International Building Code.
- C. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- E. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions, erection drawings, and shop drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
- C. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Grid Suspension Systems: Provide grid suspension systems in accordance with ASTM C840 and GA-216 complying with the following:
 - 1. ICC-ES Evaluation Report No. _____.
- D. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:

2.02 METAL FRAMING MATERIALS

- A. Material and Product Requirements Criteria: AISI S201.
- B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
 - 1. Structural Grade: As required to meet design criteria.
 - 2. Corrosion Protection Coating Designation: G40, or equivalent in accordance with AISI S220.
- C. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich; ____: www.clarkdietrich.com/#sle.
 - 2. Jaimes Industries; ____: www.jaimesind.com/#sle.
 - 3. MarinoWARE; ____: www.marinoware.com/#sle.
 - 4. Phillips Manufacturing Co; ____: www.phillipsmfg.com/#sle.
 - 5. R-stud; ____: www.rstud.com/#sle.
 - 6. SCAFCO Corporation; ____: www.scafco.com/#sle.
 - 7. Steel Construction Systems; ____: www.steelconsystems.com/#sle.
 - 8. Substitutions: See Section 016000 - Product Requirements.
- D. Nonstructural Steel Framing for Application of Gypsum Board: See Section 092216.
- E. Structural Steel Framing for Application of Gypsum Board: See Section 054000.
- F. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).

1. Studs: C-shaped with knurled or embossed faces.
 2. Runners: U shaped, sized to match studs.
 3. Ceiling Channels: C-shaped.
 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 5. Furring Members: U-shaped sections, minimum depth of 3/4 inch (19 mm).
 6. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (13 mm) channel depth.
- G. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
- H. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent 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 50/340, with G60/Z180 hot-dipped galvanized coating.
 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
 4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
 - a. Products:
 - 1) ClarkDietrich; BlazeFrame RipTrak: www.clarkdietrich.com/#sle.
 - 2) FireTrak Corporation; Posi Klip: www.fire-trak.com/#sle.
 - 3) MBA Building Supplies; Slotted Slip Track: www.mbastuds.com/#sle.
 - 4) Metal-Lite, Inc; The System: www.metal-lite.net/#sle.
 - 5) Super Stud Building Products, Inc; Slotted Deflection Track: www.buysuperstud.com/#sle.
- I. Non-structural 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. Height: _____ inches (_____ mm).
 - c. Products:
 - 1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
 3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company; _____: www.americangypsum.com/#sle.
 2. CertainTeed Corporation; _____: www.certainteed.com/#sle.
 3. Georgia-Pacific Gypsum; _____: www.gpgypsum.com/#sle.
 4. Gold Bond Building Products, LLC provided by National Gypsum Company; _____: www.goldbondbuilding.com/#sle.
 5. PABCO Gypsum; _____: www.pabco gypsum.com/#sle.
 6. USG Corporation; _____: www.usg.com/#sle.
 7. Substitutions: See Section 016000 - Product Requirements.
- B. 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.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required _____.
 4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 5. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 6. Paper-Faced Products:
 7. Mold-Resistant, Paper-Faced Products:
- C. Abuse Resistant Wallboard:
1. Application: High-traffic areas indicated.
 2. Surface Abrasion: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 4. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 6. Type: Fire-resistance-rated Type X, UL or WH listed.
 7. Thickness: 5/8 inch (16 mm).
 8. Edges: Tapered.
- D. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas, including manufactured housing, tub and shower surrounds, and shower ceilings.

2.04 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: See Section 072100.
- B. 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.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.
 - 2) ClarkDietrich; Strait-Flex OS-300: www.clarkdietrich.com/#sle.
 - 3) Flannery, Inc; Corner Beads: www.flannerytrim.com/#sle.
 - 4) Phillips Manufacturing Co; Everlast Corner Bead: www.phillipsmfg.com/#sle.
 - 5) Trim-Tex, Inc; _____: www.trim-tex.com/#sle.
 2. Splayed Corner Beads with Paper Face: _____.
 3. L-Trim with Tear-Away Strip: Sized to fit _____-inch (_____ mm) thick gypsum wallboard.
 4. Expansion Joints:
 - a. Fire-Resistance Rated: 1 hour when joint system tested in accordance with UL 2079.
 - b. Type: V-shaped metal with factory-installed protective tape.

- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
- E. Textured Finish Materials: Latex-based compound; plain.
 - 1. Products:
 - a. CertainTeed Corporation; Extreme Texture Coat/Acrylic Texture with M2Tech: www.certainteed.com/#sle.
 - b. Sherwin-Williams; Tuff Surface Premium Texture Finish: www.sherwin-williams.com/#sle.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center (at 406 mm on center).
 - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 - 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 - 3. 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.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
 - 1. Orientation: Vertical.
 - 2. Spacing: As indicated.
- F. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Toilet accessories.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

- A. 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.

- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Place continuous bead at perimeter of each layer of gypsum board.
 - 2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.06 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 (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. 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 and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, 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.
- C. 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 (0.8 mm).
- D. 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.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TEXTURE FINISH

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.
- C. Texture Required: Light Orange Peel.

3.09 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.10 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean _____.

3.11 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

**SECTION 092216
NON-STRUCTURAL METAL FRAMING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Notify manufacturer of damaged materials received prior to installation.
- B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. 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 for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft..
- D. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
- E. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.
- F. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1-1/2" inches, or as determined by the PEMB manufacturer.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with AISI S220 and ASTM C645, Section 10 for conditions indicated.
 - 1. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: AISI S220.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CEMCO; California Expanded Metal Products Co.
 - b. ClarkDietrich.
 - c. Custom Stud.
 - d. Jaimes Industries.
 - e. MarinoWARE.
 - f. MBA Building Supplies.
 - g. MRI Steel Framing, LLC.
 - h. Phillips Manufacturing Co.
 - i. SCAFCO Steel Stud Company.
 - j. Steel Construction Systems.
 - k. Telling Industries.
 - l. The Steel Network, Inc.
 - 2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
 - 3. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich.
 - 3) MarinoWARE.
 - 4) MBA Building Supplies.
 - 5) Metal-Lite.
 - 6) SCAFCO Steel Stud Company.
 - 7) Steel Construction Systems.
 - 8) Telling Industries.
 - 9) The Steel Network, Inc.

- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CEMCO; California Expanded Metal Products Co.
 - b. ClarkDietrich.
 - c. Fire Trak Corp.
 - d. MarinoWARE.
 - e. Metal-Lite.
 - f. SCAFCO Steel Stud Company.
 - g. Steel Construction Systems.
 - h. The Steel Network, Inc.

- E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

- F. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. MBA Building Supplies.
 - d. MRI Steel Framing, LLC.
 - e. SCAFCO Steel Stud Company.
 - f. Steel Construction Systems.
 2. Configuration: Asymmetrical.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
- C. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Tracks: ASTM C645.
 - a. Depth: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.

- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:

1. Screw to framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Do not attach hangers to steel roof deck.
 4. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. 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.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

**SECTION 093000
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Edge-protection and transition profiles for floors.
- D. Finishing and edge-protection for walls.
- E. Movement joint and cove-shaped profiles
- F. Uncoupling membrane
- G. Waterproofing membrane
- H. Cementitious backer board as tile substrate.
- I. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2019.
- B. ASTM D2370 - Standard Test Method for Tensile Properties of Organic Coatings; 2016 (Reapproved 2021).
- C. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct conference at the project site.
 - 1. Convene one month prior to commencing work of this section
 - 2. Require attendance of installation material manufacturer, tile supplier, tile installer and installers of related work. Review installation procedures and coordination required with related work.
 - 3. Meeting agenda includes but is not limited to:
 - a. Surface preparation.
 - b. Tile and installation material compatibility.
 - c. Manufacturer and installer warranty duration and scope covered by warranty.
 - d. Edge protection, transition, and pre-fabricated movement joint profiles.
 - e. Waterproofing techniques.
 - f. Crack isolation techniques.
 - g. Control and expansion joints.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, setting details, and metal edge strips.
- D. Samples for Verification:
 - 1. Full-size units of each type of composition of tiles
 - 2. Metal edge strips in 6-inch lengths.
 - 3. Physical sample deck of grout color options.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- 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 Tile: 5 percent of each size, color, and surface finish combination, but not less than 2 boxes of each type.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of ANSI A108/A118/A136, TCNA (HB), and TCNA (HB-GP) on-site.
- B. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.
 - a. Installer to provide references and examples upon request of Architect and/or Owner.

1.06 MOCK-UPS

- A. See Section 014000 - Quality Requirements for general requirements for mock-up.
- B. Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 - 1. Finish areas designated by Architect
 - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect and Owner.
 - 3. Refinish mock-up area as required to produce acceptable work.
 - 4. Mock-ups are to be provided upon request at no cost to the owner.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other requirement characteristics can be maintained and contamination can be avoided
- D. Store liquid materials in unopened containers and protected from freezing.

1.08 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at levels indicated in referenced standards and manufacturer's written instructions.

1.09 WARRANTY

- A. The contractor warrants the work of this section to be in accordance with the contract documents and free from faults and defects in materials and workmanship for a period of 10 years.
 - 1. Warranties that are affected by a single-source manufacturer requirement is expected and should be included.
- B. The manufacturer of adhesives, mortars, grouts, and/or other installation materials shall provide a warranty in accordance with requirements for this project.
- C. Warranty document showing duration and scope to be submitted with product submittals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Source limitations for tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area. If area covered requires more than one production run of material coordination with architect on pattern/blending is required.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this section from a single manufacturer.
 1. Waterproof membrane.
 2. Crack isolation membrane.
 3. Metal edge strips.

2.02 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 1. Provide tile complying with standard grade requirements unless otherwise indicated.
 2. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.2, ANSI standards referenced in other articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
 3. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved samples.
 4. Mounting: For factory-mounted tile, provide back or edge mounted tile assemblies as standard with manufacturer unless otherwise indicated
 - a. Where tile is indicated for installation in wet areas, do not use back or edge mounted tile assemblies unless tile manufacturer specified in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.03 TILE PRODUCT

- A. Tile Type: As indicated on drawings.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include those indicated on drawings.
 1. Size: As indicated on drawings.
 - a. Where indicated on drawings, any tile product with a single side at 24" in length or greater will require a tile leveling system to be utilized during installation.
 2. Face: As indicated on drawings.
 3. Tile Color and Pattern: As indicated on drawings.
 4. Tile Installation Pattern: As indicated on drawings.

2.04 TRIM AND ACCESSORIES

- A. Edge Protection and Transition Profiles for Floors: Angle or L-Shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; Exposed-edge Material.
 1. Applications: As indicated on drawings.
 - a. Thresholds at door openings.
 - b. Open edges of floor tile.
 - c. Transition between floor finishes of different heights.
 2. Products: As indicated on drawings.
 - a. Manufacturer: Schluter-Systems (Basis of Design).
 - b. Profile: As indicated on drawings.
 - c. Finish: As indicated on drawings.

- d. Accessories: Include matching inside and outside corners, internal connectors, and anchoring legs matching trim profiles.
 - e. Substitutions: See Section 016000 - Product Requirements.
- B. Finishing and Edge Protection for Walls: Angle or L-Shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for wall applications; Top and vertical wall sections that together form the visible surface.
- 1. Applications: As indicated on drawings.
 - a. Open edges of wall tile.
 - b. Inside and outside wall corners.
 - c. Transition between different finishes or as designated in drawings.
 - 2. Products: As indicated on drawings.
 - a. Manufacturer: Schluter-Systems (Basis of Design).
 - b. Profile: As indicated on drawings.
 - c. Finish: As indicated on drawings.
 - d. Accessories: Include matching inside and outside corners, internal connectors, and anchoring legs matching trim profiles.
- C. Movement Joint and Cove Shaped Profiles: Metal Profile with integrated anchoring legs, connected at a 90-degree angle by a cove shaped radius that forms the visible surface. Height to match tile and setting-bed thickness.
- 1. Applications: As indicated on drawings.
 - a. Floor to wall joints.
 - 2. Products: As indicated on drawings.
 - a. Manufacturer: Schluter-Systems (Basis of Design).
 - b. Profile: As indicated on drawings.
 - c. Finish: As indicated on drawings.
 - d. Accessories: Include matching inside and outside corners, internal connectors, and end caps matching trim profiles.
- D. Surface and Expansion Joint Profiles: Prefabricated movement joint profile with anchoring legs that forms the visible surface.
- 1. Applications: Floor and wall surfaces including but not limited to cold and soft joints, or as indicated on drawings.
 - a. As required by ASTM 108 and TCNA.
 - b. All expansion, construction, cold, saw-cut, isolation, contraction, and seismic joints.
 - c. Perimeter and field movement joints within a tile installation, unless other profile is indicated.
 - d. Changes in plane and interior-movement joints at all inside corners, unless other profile is indicated.
 - e. Same plane movement joints.
 - 1) Maximum of 24' in each direction. If in direct sunlight, heat or moisture maximum of 12' in each direction.
 - 2. Products: As indicated on drawings.
 - a. Manufacturer: Schluter- Systems (Basis of Design).
 - b. Profile: As indicated on drawings.
 - c. Finish. As indicated on drawings.

2.05 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer, unless otherwise noted and or indicated in manufacturer's warranty.
- B. Manufacturers:
 - 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 - 2. Bostik Inc: www.bostik-us.com/#sle.
 - 3. TEC, a H.B. Fuller Company: www.tecspecialty.com/#sle.

4. LATICRETE International, Inc: www.laticrete.com/#sle.
 5. Mapei Corporation: www.mapei.com/#sle.
 6. Schluter-Systems: www.schluter.com/#sle.
 7. Flextile Ltd.:www.flextile.net/#sle.
- C. Latex-Portland Cement Mortar Bond Coat (Thickset):
1. Applications: As applicable to project requirements and reference in ANSI A108.1B, ANSI A118.4, and TCNA.
 2. Materials: As applicable to project requirements.
 - a. Reference additional sections as it relates to cleavage membrane, reinforcing wire fabric, and expanded metal lath.
 - b. Cleavage Membrane: Asphalt felt, ASTM D226/D22M, Type I; or polyethylene sheeting, ASTM D4397, 4.0 mils thick.
 - c. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A185/A185M and ASTM A82/A82M, except for minimum wire size.
 - d. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C847.
 - 1) Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
 - 2) Configuration over Solid Surfaces: Self-furring.
 - 3) Weight: 2.5 lb/sq. yd and/or 3.4 lb/sq. yd.
 3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- D. Latex-Portland Cement Mortar Bond Coat (thinset):
1. Applications: For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15 and A118.1
 2. Products:
 - a. Schluter-Set (Basis of Design) ALL-SET.
 - b. LATICRETE International, Inc; MULTIMAX LITE: www.laticrete.com/#sle.

2.06 GROUTS

- A. Provide setting and grout materials from same manufacturer, unless otherwise noted and or indicated in manufacturer's warranty.
- B. Manufacturers:
1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 2. Bostik Inc: www.bostik-us.com/#sle.
 3. TEC, H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
 4. LATICRETE International, Inc (Basis of Design): www.laticrete.com/#sle.
 5. Mapei Corporation: www.mapei.com/#sle.
 6. Flextile Ltd.:www.flextile.net/#sle.
- C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: Wet locations, excluding kitchens.
 2. Grout Joints: As indicated in TCNA guidelines.
 3. Color(s): As selected by Architect from manufacturer's full line, unless otherwise indicated on drawings.
 4. Products:
 - a. Manufacturer: Laticrete (Basis of Design); Spectralock.

2.07 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Bonded Sheet Membrane Type:

- a. Material: Polyethylene sheet membrane with polyester fleece laminated to underside.
 - b. Products: Schluter-Systems (Basis of Design).
 - 1) Schluter-Systems; DITRA: www.schluter.com/#sle.
 - 2) Laticrete; STRATA MAT XT: www.laticrete.com/#sle.
- B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
- 1. Bonded Sheet Membrane Type:
 - a. Material: High-density polyethylene sheet membrane with nonwoven polypropylene laminated to its underside.
 - b. Products:
 - 1) Schluter-Systems; Ditra (basis of design).
 - 2) Waterproofing Seaming Membrane : Schluter-Systems; KERDI BAND (basis of design).
 - (a) Location: Seams and corners.
- C. Cementitious Backer Panel:
- 1. Application: Wall Surfaces as Required by ANSI A118.9, ASTM A108.11 and ASTM C1325 provide with manufacturer's standard edges.
 - 2. Products:
 - a. Manufacturer: USG Corporation, LLC (Basis of Design); USG Durock Cement Board.
 - b. Thickness: 5/8".
 - c. Mold Resistance: ASTM D3273 and ASTM D3274.
 - d. Minimum Bending Radius: 6 feet.
 - 3. Fastener Requirements: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and application.
 - a. Screws for fastening gypsum sheathing to cold-formed metal framing with corrosion-resistant coating.
 - b. See sections as it relates to waterproofing requirements.
- D. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.
- E. Surface and Expansion Joint Profiles: One component, neutral cure, exterior grade silicone sealant and meeting the following requirements (product must meet ASTM C920).
- 1. Application: Floor and wall surfaces including but not limited to cold and soft joints.
 - a. As required by ASTM 108 and TCNA.
 - b. All expansion, construction, control, cold, saw-cut, isolation, contraction, and seismic joints.
 - c. Perimeter and field movement joints within a tile installation.
 - d. Changes in the plane and interior-movement joints at all inside corners.
 - e. Same plane movement joints.
 - 1) Maximum of every 24' in each direction. If in direct sunlight, heat or moisture maximum of 12' in each direction.
 - 2. Manufacturer: Laticrete (Basis of Design).
 - 3. Tensile Strength (ASTM C794): 280 PSI (1.9 MPa).
 - 4. Hardness (ASTM D751; Shore A): 25 (colored sealant)/15 (clear sealant).
 - 5. Weather Resistance (QUV Weather-ometer): 10,000 (no change).
 - 6. VOC Emissions: ≤ 0.5 mg/m³
 - 7. VOC Content: ≤ 37.16 g/L.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
 - 1. Sub-contractor is responsible for notifying GC and Architect if subfloor surfaces do not meet requirements.

2. In project instances where additional leveling work is needed, the sub-contractor is required to include this as an allowance if needed in bid.
- 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 tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 1. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

3.02 INSTALLATION - GENERAL

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Install non-ceramic trim in accordance with manufacturer's instructions.
- F. Install thresholds where indicated.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.03 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 1. Remove grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.04 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic over finished floor surface for at least seven days after installation.

- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION

**SECTION 095100
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two samples 6 by 6 inch (165 by 165 mm) in size illustrating material, color, pattern and texture of acoustical units.
- E. Samples: Submit two samples each, 6 inches (165 mm) long, of suspension system main runner, cross runner, and perimeter molding.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 2 percent of total installed.

1.05 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling tile and its supporting suspension system from single source from single manufacturer.
- B. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Certaineed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
 - 3. Rockfon: www.rockfon.com/#sle.
 - 4. USG Corporation: www.usg.com/ceilings/#sle.
- C. Suspension Systems:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Certaineed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
 - 3. Rockfon: www.rockfon.com/#sle.
 - 4. USG Corporation: www.usg.com/ceilings/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Rating: Determined in accordance with test procedures in ASTM E119.
 - 1. Indicate design designations from UL (FRD) or from the listings of another qualified testing agency.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.03 ACOUSTICAL UNITS

- A. Acoustical Tiles: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - a. Form: 2, water felted.
 - 2. Size: 24 by 24 inches (610 by 610 mm).
 - 3. Thickness: 3/4 inch (19 mm).
 - 4. Light Reflectance: Not less than .90, determined in accordance with ASTM E1264.
 - 5. NRC Range: Not less than .75, determined in accordance with ASTM E1264.
 - 6. Ceiling Attenuation Class (CAC): Not less than 35, determined in accordance with ASTM E1264.
 - 7. Tile Edge: Square.
 - 8. Color: White.
 - 9. Suspension System: Exposed grid.

2.04 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- B. Exposed Suspension System: Hot-dip galvanized steel grid and cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 15/16 inch (24 mm) face width.
 - 3. Finish: Pre-painted, white.
 - 4. Products:
 - a. Obtain suspension system and Acoustical Ceiling tile from single source from single manufacturer..

2.05 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- D. Suspension System: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- G. Support fixture loads using supplementary hangers located within 3 inches (76.2 mm) of each corner, or support components independently.
- H. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.
- F. Install hold-down clips on panels within 5 ft (1.524 m) of an exterior door.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean surfaces per manufacturer's written instructions.
- C. Replace damaged or abraded components.

END OF SECTION

**SECTION 095426
SUSPENDED WOOD CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood grilles.
- B. Concealed suspension system for Linear Wood Ceiling Panels.
- C. Linear Wood Ceiling Panels for Concealed Suspension System.
- D. Trim and Accessories.
- E. Seismic restraints for suspended ceiling system.

1.02 RELATED REQUIREMENTS

- A. Section 095100 - Acoustical Ceilings: Metal suspension systems.

1.03 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- D. CISCA (WC) - Wood Ceilings Technical Guidelines; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on wood ceiling components and suspension system components.
- D. Samples: Submit two 12" by 18" inch (304.8 by 457.2 mm) samples illustrating material, pattern and finish of wood ceiling components.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Wood Ceiling Components: Provide a quantity equal to 2 percent of total product installed.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
 - 1. Installer to provide references and examples upon request of Architect and/or Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood ceiling components to project site in original, unopened packages.
- B. Store in fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination and other mistreatment.

- C. Store flat, level and off the floor
- D. Acclimatization: Before installing wood panels, permit them to reach room temperature and a stabilized moisture content (at least 72 hours) per AWI Standards.
- E. Handle Linear Wood Panels carefully to avoid chipping edges or damaging units in any way.

1.08 FIELD CONDITIONS

- A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.
- B. Maintain room temperature between 60 degrees F (16 degrees C) and 75 degrees F (24 degrees C) and relative humidity between 35 to 55 percent before, during, and after installation.

1.09 WARRANTIES

- A. Provide Owner with a (1) year warranty for material and workmanship on all installed products.
 - 1. Manufacturers: All materials, wood ceiling and grid, shall be warranted for (1) year for material and workmanship.
 - 2. Installer: All work shall be warranted for one (1) year from final acceptance of completed work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Suspended Wood Ceilings:
 - 1. 9Wood: www.9wood.com/#sle. (Basis of Design)
 - 2. Armstrong World Industries, Inc; Woodworks: www.armstrongceilings.com/#sle.
 - 3. USG Corporation: www.usg.com/ceilings/#sle.

2.02 SUSPENDED WOOD CEILING SYSTEM

- A. Performance Requirements:
 - 1. Design for maximum deflection of 1/360 of span.
- B. Wood-Based Materials:
 - 1. Solid Wood: Clear, dry, sound, plain sawn, selected for grain and color, no defects.
- C. Wood Grilles: Pre-assembled module of solid wood grilles with battens.
 - 1. Module Size: 12 by 120 inches (304.8 by 3048 mm), nominal.
 - 2. Solid Wood Species: As indicated on Drawings.
 - a. Factory Finish: Wood stain as selected, clear sealer top coat.
 - 3. Attachment to Suspension Grid: Direct screw attachment to suspension grid.
 - 4. Suspension System: Type specified below.
- D. Metal Suspension System:
 - 1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
 - 2. Exposed Suspension System: Hot-dipped galvanized steel grid.
 - a. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
 - b. Profile: Tee; 15/16 inch (24 mm) face width.
 - c. Finish/Color: Baked enamel, black.
 - 3. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.
- E. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.

- B. Do not install ceiling until after interior wet work is dry.

3.02 PREPARATION

- A. Coordinate the location of hangers with other work.
- B. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.
- C. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 72 hours prior to installation.

3.03 INSTALLATION

- A. General: Install suspended wood ceiling system in accordance with CISCA (WC).
- B. Suspension System:
 - 1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
 - 2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
 - 3. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
 - 4. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
 - 5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
 - 6. Do not eccentrically load system or induce rotation of runners.
- C. Wood Ceiling:
 - 1. Install wood ceilings in accordance with manufacturer's instructions.
 - 2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
 - 3. Install components in uniform plane, and free from twist, warp, and dents.
 - 4. Cut to fit irregular grid and perimeter edge trim.
 - 5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.

3.04 CLEANING

- A. Clean and touch up minor finish damage per manufacturer's cleaning and damage repair instructions. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION

**SECTION 096500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient base and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for each type of product
- C. Verification Samples: Submit samples for each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size sample, but not less than 2 inches long.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project from same product run, with protective covering for storage and identified with labels describing contents.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern and size of resilient product installed

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store all materials off of the floor in an acclimatized, weather-tight space.
- B. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

1.05 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 RESILIENT BASE (RB)

- A. Resilient Base: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.
 - 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - b. Mannington Commercial: www.manningtoncommercial.com/#sle.
 - 2. Height: 4 inches (100 mm).
 - 3. Thickness: 0.125 inch (3.2 mm).
 - 4. Finish: Satin.
 - 5. Length: Coils in manufacturer's standard length.
 - 6. Color: As indicated on drawings.
 - 7. Outside and Inside corners: Job Formed.

2.02 ACCESSORIES

- A. Moldings, Transition and Edge Strips:
 - 1. Manufacturers:
 - a. Johnsonite, a Tarket Company: www.johnsonite.com/
 - b. Mannington Commercial: www.manningtoncommercial.com/#sle
 - 2. Description: Resilient reducer strip for carpet tile
 - 3. Profile and Dimensions: As indicated on Drawings
 - 4. Locations: As indicated on Drawings

5. Colors & Patterns: As indicated on Drawings

PART 3 EXECUTION

3.01 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.

3.02 PREPARATION

- A. Prepare substrates as recommended by manufacturer's written instructions to ensure adhesion of resilient products.
- B. Do not install resilient products until materials are the same temperature as space where they are to be installed.

3.03 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's written instructions.
- B. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
1. Resilient Transition Strips: Attach to substrate using adhesive.

3.04 INSTALLATION - RESILIENT BASE

- A. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Do not stretch resilient base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- F. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
- a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

3.05 INSTALLATION - RESILIENT ACCESSORY

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

**SECTION 096813
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, including walk-off tiles, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
- C. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics, warranty; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: For carpet tile installation, plans showing the following
 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 2. Carpet tile type, color, and dye lot.
 3. Type of subfloor.
 4. Type of installation.
 5. Type, color, and location of edge, transition, and other accessory strips.
 6. Transition details to other flooring materials.
- D. Samples: Submit one full-size carpet tile illustrating color and pattern design for each carpet color selected.
 1. Label each sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
- E. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 016000 - Product Requirements, for additional provisions.
 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed, but not less than 10 sq. yds.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum five years documented experience.
 1. Installer to provide references and examples upon request of Architect and/or Owner.

1.06 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.07 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failure include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Loss of face fiber.
 - d. Delamination.
 - 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tile Carpeting:
 - 1. Interface, Inc: www.interface.com/#sle.
 - 2. J&J Invision; J&J Industries, Inc.: www.jjflooringgroup.com/#sle.
 - 3. Mannington Commercial: www.manningtoncommercial.com/#sle.
 - 4. Mohawk Group: www.mohawkgroup.com/#sle.
 - 5. Tarkett: www.commercial.tarkett.com/#sle.

2.02 MATERIALS

- A. Tile Carpeting: Patterned Loop, manufactured in one color dye lot.
 - 1. Tile Size: As indicated on Drawings.
 - 2. Color: As indicated on Drawings.
 - 3. Pattern: As indicated on Drawings.
 - 4. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
 - 5. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2.03 ACCESSORIES

- A. Subfloor Filler: Type recommended by flooring material manufacturer.
- B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Installation Method: As recommended in writing by carpet tile manufacturer. Glue down; install every tile with full-spread, releasable, pressure sensitive adhesive.
- D. Maintain dye-lot integrity. Do not mix dye lots in same area.
- E. Lay carpet tile in pattern as indicated on Drawings, with pile direction parallel to next unit, set parallel to building lines.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Trim carpet tile neatly at walls and around interruptions.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Remove yarns that protrude from carpet tile surface.
- C. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 9113
EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Primers.
 - 2. Finish coatings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include preparation requirements and application instructions.
 - 2. Indicate VOC content.
- B. Samples: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product Schedule: Use same designations indicated on Drawings and in the Exterior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Behr Paint Company; Behr Process Corporation.
 2. Benjamin Moore & Co.
 3. PPG Paints.
 4. Sherwin-Williams Company (The).
 5. Valspar Corporation (The).
- B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

- A. Material Compatibility:
 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range or As indicated in a color schedule.
 1. percent of surface area will be painted with deep tones.

2.3 PRIMERS

- A. Water-Based, Rust-Inhibitive Primer: Corrosion-resistant, water-based-emulsion primer formulated for resistance to flash rusting when applied to cleaned, exterior ferrous metals subject to mildly corrosive environments.

2.4 FINISH COATINGS

- A. Exterior, Water-Based, Light Industrial Coating, Semigloss: Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 3.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Tanks that do not have factory-applied final finishes.
 - g. .

3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
 - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
 - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
 - 3. Allow empty paint cans to dry before disposal.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 EXTERIOR PAINTING SCHEDULE

A. Steel and Iron Substrates:

1. Water-Based, Light Industrial Coating System Insert drawing designation:
 - a. Prime Coat: Alkyd metal primer Shop primer specified in Section in which substrate is specified.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Exterior, water-based, light industrial coating, semigloss.

END OF SECTION

**SECTION 099123
INTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints. Refer to project drawings for substrates defined throughout project. Project may include but is not limited to:
 - 1. Concrete Walls: Precast concrete, unglazed brick, fiber cement board, tilt-up concrete, cast-in-place concrete, and plaster.
 - 2. Concrete Ceilings: Precast concrete, fiber cement board, cast-in-place concrete, and plaster.
 - 3. Concrete Masonry Units: Split face, scored, smooth, high density, low density, and fluted
 - 4. Metal: Aluminum and galvanized.
 - 5. Galvanized Metal: Ceilings and ductwork.
 - 6. Hollow metal doors and Frames.
 - 7. Wood: Walls, ceilings, doors and trim.
 - 8. Drywall: Walls, ceilings, gypsum board, and similar items.
 - 9. Concrete: Floors (non-vehicular).
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. 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. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Acoustical materials, unless specifically indicated.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 4500 - Precast Architectural Concrete: For interior exposed sides.
- C. Section 05 1200 - Structural Steel Framing: For shop priming structural steel.
- D. Section 055000 - Metal Fabrications: Shop-primed items.
- E. Section 099113 - Exterior Painting.
- F. Section 07 2119 - Spray-On Insulation.
- G. Section 099600 - High-Performance Coatings.

1.03 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. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application; 2018.

- E. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

1.04 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. Product characteristics.
 - 2. Surface preparation instructions and recommendations.
 - 3. Primer requirements and finish specification.
 - 4. Storage and handling requirements and recommendations.
 - 5. Application methods.
 - 6. Clean-Up information.
 - 7. 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 (216 by 279 mm) 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.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. 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.
- F. 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: 5 percent, but not less than 1 gal of each material and color applied, unless otherwise approved by owner. Paint to be from the same product run, unopened and labeled "For owner use only".
 - 3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with a minimum of 5 years experience.
 - 1. References and examples available upon request by owner/architect.

1.06 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Apply mock-ups of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
- C. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - 1. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - 2. Other Items: Architect will designate items or areas required.
- D. Final approval of color selections will be based on mockups.

1. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
- E. Approval of mock-ups does not constitute approval of deviations from the contract documents contained in mock-ups unless Architect specifically approves such deviations in writing.
- F. Subject to compliance with requirements, approved mock-up may remain as part of the work if undisturbed at time of substantial completion.

1.07 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. Maintain containers in clean condition, free of foreign materials and residue.
- D. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 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 (3 degrees C) above the dew point, or to damp or wet surfaces.
- D. Apply paints only when the temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F.
- E. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; unless otherwise specified.
- B. Subject to compliance with requirements, provide products that meet or exceed performance and physical characteristics of basis of design.
- C. Manufacturers:
 1. Sherwin-Williams Company (Basis of design).
 2. Benjamin Moore & Company.
 3. Glidden Professional.
 4. PPG Paints.
 5. Diamond Vogel Paints.
 6. Rust-Oleum Corporation.
 7. Valspar Corporation.
 8. Scuffmaster, Wolf-Gordon Inc.
- D. Substitutions: See Section 016000 - Product Requirements.

2.02 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. Supply each paint material in quantity required to complete entire project's work from a single production run.
 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted.
- C. Volatile Organic Compound (VOC) Content: See Section 016116.
- D. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements.
- E. Colors and Finish Sheen: As indicated in the finish schedule.

2.03 PAINT SYSTEMS - INTERIOR

- A. General:
1. Refer to project drawings for colors, finishes, substrates defined throughout project. The following systems are utilizing Sherwin-Williams as the basis of design; substitutions subject to compliance with requirements, provide products that meet or exceed performance and physical characteristics of basis of design.
- B. Metal: Aluminum and galvanized.
1. Epoxy Systems, Water-Based: Single Component Pre-Catalyzed Waterbased Epoxy
 - a. Semi-Gloss Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46 Series.
 - b. Eg-Shel/Low Luster Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series.
 2. Alkyd Systems, Water-Based
 - a. Gloss Systems:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Gloss, B53-1050 Series.
 - b. Semi-Gloss Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series.
 - c. Low Sheen Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Low Sheen, B53-1250 Series.
- C. Metal, Galvanized: Ceilings and ductwork.
1. Dryfall Waterborne Topcoats:
 2. Semi-Gloss Finish:
 - 1) 1st and 2nd Coat: Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall, B42-83 Series: www.sherwin-williams.com/#sle.
 - b. Eg-Shel Finish:

- 1) 1st and 2nd Coat: Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall, B42-82 Series.
 - c. Flat Finish:
 - 1) 1st and 2nd Coat: Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall, B42-181 Series.
 - (a) Alternate: Existing Exposed Ceilings.
 - 3. Gloss, Semi-Gloss, Eg-Shel or Matte Finish High Performance:
 - a. 1st and 2nd Coat: Sherwin-Williams Pro Industrial Multi-Surface Acrylic, B66-1500 Series.
- D. Hollow Metal Doors and Frames: Single Component Pre-Catalyzed Waterbased Epoxy .
 - 1. Epoxy Systems, Water-Based:
 - a. Semi-Gloss Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46 Series.
 - b. Eg-Shel/Low Luster Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series.
 - 2. Alkyd Systems, Water-Based.
 - a. Gloss Systems:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Gloss, B53-1050 Series.
 - b. Semi-Gloss Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series.
 - c. Low Sheen Finish:
 - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Low Sheen, B53-1250 Series.
- E. Wood: Walls, ceilings, doors, and trim.
 - 1. Alkyd Systems, Water-Based: LEED VOC only.
 - a. Gloss Systems:
 - 1) 1st Coat: Sherwin-Williams Multi-Purpose Int./Ext. Primer/Sealer, B51-450.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Gloss, B53-1050 Series.
 - b. Semi-Gloss Finish:
 - 1) 1st Coat: Sherwin-Williams Multi-Purpose Int./Ext. Primer/Sealer, B51-450.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Semi-Gloss, B53-1150 Series.
 - c. Low Sheen Finish:
 - 1) 1st Coat: Sherwin-Williams Multi-Purpose Int./Ext. Primer/Sealer, B51-450.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Alkyd Urethane Enamel Low Sheen, B53-1250 Series.
 - 2. Stain and Varnish System:
 - a. Gloss Finish:

- 1) 1st Coat: Sherwin-Williams Minwax Performance Series Tintable Wood Stain 250 VOC.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Minwax Waterbased Oil-Modified Polyurethane, 275 VOC.
 - b. Satin Finish:
 - 1) 1st Coat: Sherwin-Williams Minwax Performance Series Tintable Wood Stain 250 VOC.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Minwax Waterbased Oil-Modified Polyurethane, 275 VOC.
- F. Drywall: Walls, ceilings, gypsum board, and similar items.
 - 1. Latex Systems:
 - a. Semi-Gloss Finish:
 - 1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series.
 - (a) Alternate: S26 Series Scuff Tuff Semi-Gloss.
 - 2. Eg-Shel Finish:
 - a. 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 1) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Eg-Shel, B20-2600 Series.
 - (a) Alternate: S24 Series Scuff Tuff Eg-Shel.
 - b. Flat Finish:
 - 1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Latex Flat, B30-2600 Series.
 - (a) Alternate: S23 Series Scuff Tuff Matte or S22 Series Scuff Tuff Flat.
 - 3. Epoxy Systems, Water-Based: Single Component Pre-Catalyzed Waterbased Epoxy.
 - a. Semi-Gloss Finish:
 - 1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46 Series.
 - b. Eg-Shel/Low Luster Finish:
 - 1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
 - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45 Series.
 - G. Concrete: Floors, non-vehicular.
 - 1. Latex Systems:
 - a. Semi-Gloss Finish:
 - 1) 1st and 2nd Coat: Sherwin-Williams Tread-Plex Acrylic Floor Coating, B90 Series.
 - b. Satin Finish:
 - 1) 1st and 2nd Coat: Sherwin-Williams Porch and Floor Enamel, A32-200 Series.
 - 2. Epoxy Systems: Water-Based: Two Component Catalyzed Waterbased Epoxy.
 - a. Gloss Finish:
 - 1) 1st and 2nd Coat: Sherwin-Williams Armorseal 8100 Waterbased Epoxy, B70-8100 Series.
 - b. Satin Finish:
 - 1) 1st and 2nd Coat: Sherwin-Williams Armorseal 8100 Waterbased Epoxy, B70-8100 Series.

2.04 TEXTURED COATING

- A. Primer for textured coating, latex, light orange peel: As recommended in writing by topcoat manufacturer.
- B. Intermediate coat for textured coating, latex, flat: As recommended in writing by topcoat manufacturer.

2.05 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to project site, samples may be taken at project site. Samples will be identified, sealed, and certified by testing.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove non-complying paint materials from project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. 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. Plaster and Stucco: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 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 or 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. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high-alkali surfaces.
- I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- 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. Prime bare steel surfaces.

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.

3.03 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. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniformed paint finish, color, and appearance.
- F. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brushmarks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- H. Sand metal surfaces lightly between coats to achieve required finish.
- I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- J. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint the following work where exposed in equipment rooms:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, included panelboards.
 - b. Uninsulated metal piping. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Other items as directed by Architect.
- K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.05 PROTECTION

- A. Protect finishes until completion of project. Including work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 101423
PANEL SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Panel signage.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Verification Samples: Submit samples showing colors, materials, and finishes specified.
- F. Manufacturer's qualification statement.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- C. Maintain minimum ambient temperature during and after installation.

1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Panel Signage:
 - 1. 2/90 Sign Systems: www.290signs.com/#sle.
 - 2. Best Sign Systems, Inc: www.bestsigns.com/#sle.

3. Inpro Corporation: www.inprocorp.com/#sle.
4. Takeform: www.takeform.net/#sle.

2.02 REGULATORY REQUIREMENTS

- A. Accessibility Requirements: 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 restrictive requirements.

2.03 PANEL SIGNAGE

- A. Panel Signage:
 1. Application: Room and door signs.
 2. Description: Flat signs with engraved panel media, tactile characters.
 3. Sign Size: As indicated on drawings.
 4. Total Thickness: 1/8 inch (3 mm).
 5. Sign Edges: Squared.
 6. Corners: Squared.
 7. Color and Font, unless otherwise indicated:
 - a. Character Font: As indicated on Drawings.
 - b. Character Case: Upper and lower case (title case).
 - c. Background Color: As Selected from Manufacturers full line colors.
 - d. Character Color: As Selected from Manufacturers full line colors.
 8. Material: Laminated colored plastic engraved through face to expose core as background color.
 9. Profile: Flat panel without frame.
 10. Tactile Letters: Raised 1/32 inch minimum.
 11. Braille: Grade II, ADA-compliant.
 12. One-Sided Wall Mounting: Tape adhesive.

2.04 ACCESSORIES

- A. Tape Adhesive: Double-sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Install using mounting methods indicated and in accordance with manufacturer's written instructions.
- B. Install signs level, plumb, true to line, and at locations indicated on Drawings.
- C. Mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

**SECTION 102600
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Blocking for wall and corner guard anchors.

1.03 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit one section of impact-resistant wall-protection, 6 inches (152 mm) long in each color and texture specified.
- E. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in a vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Special Warranty: Manufacturer agrees to repair or replace components of wall-protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 2. Inpro: www.inprocorp.com/#sle.
 3. Koroseal Interior Products: www.koroseal.com/#sle.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 1. Material: High impact vinyl with full height extruded aluminum retainer.
 2. Width of Wings: 2 inches (51 mm).
 3. Corner: Square.
 4. Color: As indicated on Drawings.
 5. Length: As indicated on Drawings.
 6. Preformed end caps.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that substrate surfaces for adhered items are clean and smooth.
- C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches (102 mm) above finished floor.

3.03 CLEANING

- A. Clean corner guards of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

**SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Under-lavatory pipe supply covers.
- C. Diaper changing stations.

1.02 RELATED REQUIREMENTS

- A. Section 093000 - Tiling: Ceramic washroom accessories.
- B. Section 224000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
- F. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.
- G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

1.05 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.

1.06 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 2. Bradley Corporation: www.bradleycorp.com/#sle.
 - 3. Bobrick Washroom Equipment, Inc.: www.bobrick.com/#sle.

2.02 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.
- B. Keys: Provide 6 keys for each accessory to Owner.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser (TPD): Double roll, surface-mounted, stainless steel unit with pivot hinge, tumbler lock.
- B. Paper Towel Dispenser (PTD): Manual, roll paper type.
 - 1. Cover: Stainless steel.
 - 2. Paper Discharge: Manual dispense by lever operation.
 - 3. Capacity: 6-inch diameter roll.
 - 4. Mounting: Surface mounted.
 - 5. Refill Indicator: Transparent viewing slot.
- C. Soap Dispenser (SD): Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
- D. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size: As indicated on drawings.
 - 3. Frame: 0.05 inch (1.3 mm) angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
- E. Grab Bars (GB): Stainless steel, smooth surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
 - b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
 - c. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
 - d. Length and Configuration: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

3.02 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.
 - 1. Grab Bars: As indicated on drawings.
 - 2. Other Accessories: As indicated on drawings.

3.03 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions
- C. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

**SECTION 104413
FIRE PROTECTION SYSTEMS**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

- a. Portable fire extinguisher.**

B. Related Requirements:

- 1. Section 10 4416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinet**

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

- 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.**

B. Shop Drawings: For fire-protection cabinets.

- 1. Include plans, elevations, sections, details, and attachments to other work.**

C. Samples: For each type of exposed finish required.

D. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.

E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis.
 - b. Guardian Fire Equipment, Inc.
 - c. Larsens Manufacturing Company.
 - d. Potter Roemer LLC; a Division of Morris Group International.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Fully glazed panel with frame.

- I. Door Glazing: Tempered break glass.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard.
 - 2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.
- K. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 - 3. Break-Glass Door Handle: Manufacturer's standard, integral to glass with the words "PULL TO BREAK GLASS" applied to handle.
 - 4. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 5. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Decals.
 - 3) Lettering Color: White.
 - 4) Orientation: Vertical.
 - 6. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.
- L. Materials:
 - 1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.

- b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.
 2. Tempered Break Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.4 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames and grind smooth
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 - 4. Fire-Rated Cabinets:
 - a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
 - b. Seal through penetrations with firestopping sealant as specified in Section 07 8413 "Penetration Firestopping."
- C. Identification:
 - 1. Apply decals at locations indicated.
 - 2. Apply decals on field-painted fire-protection cabinets after painting is complete.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

PART 1 - GENERAL

1.5 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguisher.
- B. Related Requirements:
 - 1. Section 10 4416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches square.
- E. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manual

1.8 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.6 MANUFACTURERS

- A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.7 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis.
 - b. Guardian Fire Equipment, Inc.
 - c. Larsens Manufacturing Company.
 - d. Potter Roemer LLC; a Division of Morris Group International.
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Cold-rolled steel sheet.
- D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
 - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Fully glazed panel with frame.

- I. Door Glazing: Tempered break glass.
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard.
 - 2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.
- K. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
 - 3. Break-Glass Door Handle: Manufacturer's standard, integral to glass with the words "PULL TO BREAK GLASS" applied to handle.
 - 4. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 5. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
 - 1) Location: Applied to cabinet door.
 - 2) Application Process: Decals.
 - 3) Lettering Color: White.
 - 4) Orientation: Vertical.
 - 6. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.

L. Materials:

- 1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: As selected by Architect from manufacturer's full range.
- 2. Tempered Break Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 1.5 mm thick.

2.9 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
 2. Miter corners and grind smooth.
 3. Provide factory-drilled mounting holes.
 4. Prepare doors and frames to receive locks.
 5. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Fabricate door frames of one-piece construction with edges flanged.
 3. Miter and weld perimeter door frames and grind smooth.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.5 EXAMINATION

- A. Examine roughing-in for hose and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.6 PREPARATION

- A. Prepare recesses for fire-protection cabinets as required by type and size of cabinet and trim style.

3.7 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
 - 4. Fire-Rated Cabinets:
 - a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
 - b. Seal through penetrations with firestopping sealant as specified in Section 07 8413 "Penetration Firestopping."
- C. Identification:
 - 1. Apply decals at locations indicated.
 - 2. Apply decals on field-painted fire-protection cabinets after painting is complete.

3.8 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 122400 WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior manual roller shades.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 REFERENCE STANDARDS

- A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.
- B. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
- B. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product to be used including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
- D. Selection Samples: Include samples as indicated on Drawings.
- E. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.
- F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.
 - 1. Manufacturer's authorized representative.
 - 2. Factory training and demonstrated experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.08 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

- A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: One year.
 - 2. Fabric: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Interior Manually Operated Roller Shades:
 - 1. Draper, Inc: www.draperinc.com/#sle.
 - 2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
 - 3. Levolor: www.commercial.levolor.com/#sle.
 - 4. MechoShade Systems LLC: www.mechoshade.com/#sle.
 - 5. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com/#sle.

2.02 ROLLER SHADES

- A. General:
 - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Roller Shades - Basis of Design: MechoShade Systems LLC; Mecho/5 System; www.mechoshade.com/#sle.
 - 1. Description: Single roller, manually operated fabric window shades.
 - a. Drop Position: Regular roll.
 - b. Mounting: Window jamb mounted.
 - c. Size: As indicated on drawings.
 - d. Fabric: As indicated on drawings.
 - 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - 3. Roller Tubes:
 - a. Material: Extruded aluminum.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
 - d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
 - 4. Hembars: Designed to maintain bottom of shade straight and flat.
 - a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
 - 5. Clutch Operator: Manufacturer's standard material and design integrated with bracket/brake assembly.
 - a. Provide a permanently lubricated brake assembly mounted on an oil-impregnated hub with wrapped spring clutch.
 - b. Brake must withstand minimum pull force of 50 lb (22.7 kg) in the stopped position.
 - 6. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 lb (43 kg) minimum breaking strength. Provide upper and lower limit stops.
 - a. Chain Retainer: Chain tensioning device complying with WCMA A100.1.
 - 7. Accessories:
 - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; fabric wrapped finish to match shade.

2.03 SHADE FABRIC

- A. Fabric: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
 - 1. Performance Requirements:
 - a. Flammability: Pass NFPA 701 large and small tests.
 - 2. Openness Factor: 3%, nominal.
 - 3. Color: As indicated on Drawings.

2.04 ROLLER SHADE FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
 - 1. Vertical Dimensions: Fill openings from head to sill with 1/8 inch (3.18 mm) space between bottom bar and window sill.
 - 2. Horizontal Dimensions - Inside Mounting: Provide symmetrical light gaps on both sides of shade not to exceed 1/2 inch (12.7 mm) total.
- C. Dimensional Tolerances: As recommended in writing by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.05 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 123600 COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Wall-hung counters and vanity tops.
- C. Sinks molded into countertops.
- D. Solid Surface material windowsills

1.02 RELATED REQUIREMENTS

- A. Section 064100 - Architectural Wood Casework

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- D. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.
- E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 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. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation .
- D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- E. Installation Instructions: Manufacturer's installation instructions and recommendations.
- F. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation area.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet, Type PLAM: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
 - a. Manufacturers:
 - 1) Formica Corporation: www.formica.com/#sle.
 - 2) Panolam Industries International, Inc: www.panolam.com/#sle.
 - 3) Wilsonart: www.wilsonart.com/#sle.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - d. Laminate Core Color: Manufacturer's standard core unless otherwise noted on Drawings.
 - e. Finish: As indicated on Drawings.
 - f. Surface Color and Pattern: As indicated on drawings.
 - 2. Exposed Edge Treatment: Molded 3mm PVC edge, sized to completely cover edge of panel.
 - a. Color: As selected by Architect from the manufacturer's full line.
 - 3. Back and End Splashes: Same material, same construction.
 - 4. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.
- C. Solid Surfacing Countertops and Windowsills: Solid surfacing sheet over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
 - 2. Solid Surfacing Sheet: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Dupont: www.corian.com/#sle.
 - 2) Formica Corporation: www.formica.com/#sle.
 - 3) Wilsonart: www.wilsonart.com/#sle.
 - 4) Substitutions: See Section 016000 - Product Requirements.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Sinks and Bowls: Integral castings; minimum 3/4 inch (19 mm) wall thickness; comply with IAPMO Z124.
 - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - e. Color and Pattern: As indicated on drawings.
 - 3. Other Components Thickness: 1/2 inch (12 mm), minimum.

4. Exposed Edge Treatment, Countertops: Built up to minimum 1-1/4 inch (32 mm) thick; square edge.
5. Exposed Edge Treatment, Windowsills: 1/2 inch thick, square edge.
6. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
7. Aprons: As indicated on drawings.
8. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Custom Grade.

2.02 MATERIALS

- A. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf (20 kg/cu m) minimum density; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Silicone sealant, clear.

2.03 ACCESSORIES

- A. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic cups with slot for wire passage.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Doug Mockett & Company, Inc.
 2. Outside Diameter: 2 inches.
 3. Color: As selected by Architect from manufacturer's full colors.
 4. Coordinate locations with Architect and Electrical plans.
- B. Concealed Support Bracket:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Rakks Brackets; Inside Wall-Flush Mount EH Bracket: www.rakks.com/#sle.
 2. Material: Steel.
 3. Finish: Manufacturer's standard, factory-applied.
 4. Size: Sufficient length and height to support the countertop depth indicated on Drawings.
 5. Accessories: Provide blocking as required for use with Solid Surface countertops.

2.04 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 1. Join lengths of tops using best method recommended by manufacturer.
 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inch (400 mm) on center.
 3. Height: 4 inches (102 mm), unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and windowsills up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.
- D. Wall-Mounted Counters: Provide aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install vanities in accordance with manufacturer's instructions and approved shop drawings.
- B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- C. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
- E. Attach solid surface windowsills using adhesive recommended by solid surface material manufacturer.
- F. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 ADJUSTING AND CLEANING

- A. Clean countertops exposed and semi-exposed surfaces thoroughly.
- B. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- C. Follow manufacturer's cleaning standards and guide.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 133419
METAL BUILDING SYSTEMS**

SECTION 13 3419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Structural steel framing system.
- B. Metal roof system.
- C. Metal wall system.
- D. Roof and wall insulation systems.
- E. Building components.
- F. Accessories and trim.

1.2 RELATED REQUIREMENTS:

- A. Section 033000 - Cast-In-Place Concrete: Anchor bolt installation.
- B. Section 09260 - Gypsum Board.
- C. Section 09900 - Painting.
- D. Mechanical Divisions.
- E. Electrical Divisions.

1.3 DEFINITIONS:

- A. Bay Spacing: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured perpendicular to end wall (outside face of end-wall girt).
- B. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of stud to outside face of stud).
- C. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of stud to outside face of stud).
- D. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame, or knee).
- E. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
- F. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.
- G. Terminology Standard: Refer to MBMA's "Low Rise Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 SYSTEM PERFORMANCE REQUIREMENTS:

- A. General: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, roof and wall panels, and accessories complying with requirements indicated, including those in this Article.
- B. Metal Building System Design: Of size, spacing, slope, and spans indicated, and as follows:
 - 1. Primary Frame Type:
 - a. Rigid Clear Span: Solid-member structural-framing system without interior columns.
 - b. Lean-to: Solid-member structural-framing systems designs to be partially supported by another structure.
 - 2. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, as follows:
 - a. Grid 1 (south end wall): Primary frame with an interior column, capable of supporting one-half of a bay design load, and end-wall columns.
 - b. Grid 4 (north end wall): Load-bearing end-wall and corner columns and rafters.
 - 3. Secondary Framing: Purlins and girts supported by primary frame members.
 - 4. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings.
 - 5. Bay Spacing: As indicated.
 - 6. Roof Slope: As indicated.
 - 7. Roof System: Manufacturer's standard roof panels with insulation as specified on drawings.
 - 8. Exterior Wall System: As specified on drawings.
- C. Structural Performance: Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Engineer metal building systems according to procedures in MBMA's "Low Rise Building Systems Manual."
 - 2. Design Loads:
 - a. As indicated on Drawings.
 - b. Comply with load requirements of MBMA's "Low Rise Building Systems Manual."
 - 3. Deflection and Drift Limits:
 - a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - b. No greater than the following:
 - 1) Purlins and Rafters: Vertical deflection of 1/180 of the span.
 - 2) Girts: Horizontal deflection of 1/240 of the span.
 - 3) Metal Roof Panels: Vertical deflection of 1/60 of the span.
 - 4) Metal Wall Panels: Horizontal deflection of 1/90 of the span.
 - 5) Lateral Drift: Maximum of 1/100 of the building height.
 - c. Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
- D. Thermal Performance: Provide metal building roof and wall assemblies with the following thermal-resistance values (R-value):
 - 1. Roof Assemblies: R 25 + R 11
 - 2. Wall Assemblies: R 30

3. Metal Building thermal performance must comply with 2021 IECC requirements.
- E. Water Penetration for Roof Panels: Provide roof panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 1646 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft..
- F. Water Penetration for Wall Panels: Provide wall panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft..
- G. Wind-Uplift Resistance: Provide roof panel assemblies that meet requirements of UL 580 for the following wind-uplift resistance:
 1. Class 90

1.6 SUBMITTALS:

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:
 1. Structural-framing system.
 2. Roof panels.
 3. Wall panels
 4. Liner Panels
 5. Soffit Panels
 6. Insulation products and vapor barrier
 7. Accessories.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Installation methods.
- C. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other Work.
 1. For installed components indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. Anchor-Bolt Plans: Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
 3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, representing actual product, color, and patterns.
- F. Preventative Maintenance Manual.

- G. Warranties: Special warranties specified in this Section.
- H. Energy Code Compliance: Include COMcheck report showing compliance with 2021 International Energy Conservation Code for roof and wall assemblies.

1.7 QUALITY ASSURANCE:

- A. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal building systems that are like those indicated for this project in material, design, and extent.
- C. Manufacturer Qualifications: A firm experienced in manufacturing metal building systems like those indicated for this Project and with a record of successful in-service performance.
 - 1. Engineering Responsibility: Preparation of Shop Drawings, testing program development, test result interpretation, and comprehensive engineering analysis by a qualified professional engineer.
- D. Delegated-Design Submittal: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Source Limitations: Obtain each type of metal building system component through one source from a single manufacturer.
- F. Regulatory Requirements: Fabricate and label structural framing to comply with special inspection requirements at point of fabrication for welding and other connections required by authorities having jurisdiction.
- G. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- H. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package roof and wall panels for protection during transportation and handling.
- B. Handling: Unload, store, and erect roof and wall panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight and ventilated covering. Store roof and wall panels to ensure dryness. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Established Dimensions for Foundations: Where field measurements cannot be made without delaying the Work, establish foundation dimensions and proceed with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
 - 2. Established Dimensions for Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating roof and wall panels without field measurements or allow for field-trimming panels.

Coordinate roof and wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

1.10 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Base Bid. Special Warranty on Panels: Written warranty, executed by manufacturer agreeing to repair or replace roof and wall panels that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion.
- C. Base Bid. Special Warranty on Wall Panel Finishes: Written warranty, signed by manufacturer agreeing to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
 - 1. Warranty Period for Wall Panels: 20 years from date of Substantial Completion.
- D. **Alternate No. 2 Special Warranty on Standing-Seam Roof Panel Weathertightness:** Written warranty, signed by manufacturer agreeing to repair or replace standing-seam roof panel assemblies that fail to remain weathertight within specified warranty period due to material defect(s).
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Buildings Company.
 - 2. Butler Manufacturing Company.
 - 3. Ceco Building Systems.
 - 4. Nucor Building Systems.
 - 5. Alliance Metal Buildings
 - 6. MidWest Steel Building Co.
 - 7. Chief Metal Building Systems
 - 8. Varco Pruden Buildings
 - 9. Star Buildings
 - 10. Architect approved equivalent.

2.2 STRUCTURAL-FRAMING MATERIALS:

- A. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
- B. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
- C. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
- D. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.
- E. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
- F. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
- G. Metallic-Coated Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 coating designation; mill phosphatized.
- H. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 coating designation.
 - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, SS, Grade 50 or 80; with Class AZ50 coating.
- I. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.
 - 1. Finish: Plain, uncoated.
- J. High-Strength Bolts, Nuts, and Washers, Grade A325: ASTM F3125/F3125M, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Plain, uncoated.
- K. Anchor Rods, Bolts, Nuts, and Washers:
 - 1. Unheaded Rods: ASTM F1554-36.
 - 2. Nuts: ASTM A563 heavy-hex carbon steel.
 - 3. Plate Washers: ASTM A36/A36M carbon steel.
 - 4. Washers: ASTM F436 hardened carbon steel.
 - 5. Finish: Plain
- L. Primers: As selected by manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems, capability to provide a sound foundation for field applied topcoats despite prolonged exposure, and as follows:
- M. Primer: Manufacturer's standard, lead- and chromate-free, non-asphaltic, rust-inhibiting primer.
- N. Primer color for primary and secondary framing shall be gray.

2.3 PANEL MATERIALS:

- A. Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M and the following requirements:

1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating, Grade 40; structural quality.
 2. Surface: Smooth, flat, mill finish.
- B. Panel Sealants: Provide one of the following:
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2-inch-wide and 1/8-inch-thick.
- C. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant; of type, grade, class, and use classifications required to seal joints in panels and remain weathertight; and as recommended by metal building system manufacturer.

2.4 INSULATION MATERIALS:

- A. Fire-Test-Response Characteristics for Insulation: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface-Burning Characteristics: ASTM E 84.
 2. Fire-Resistance Ratings: ASTM E 119.
- B. Combustion Characteristics: ASTM E 136.
- C. Insulation R-value, system and components shall be provided as described by architectural drawings and details.

2.5 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly and disassembly.
1. Fabricate components in a manner that once assembled in the shop, they may be disassembled, repackaged, and reassembled in the field.
 2. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 3. Fabricate framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Cold-formed members shall be free of cracks, tears, and ruptures.
- B. Primary Framing: Shop-fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
 3. Brace compression flange of primary framing by angles connected between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 4. Weld clips to frames for attaching secondary framing members.
 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary structural members with specified primer after fabrication. Color: Gray.

- C. Secondary Framing: Shop-fabricate framing components to indicated size and section by roll forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - 1. Make shop connections by welding or by using non-high-strength bolts.
 - 2. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime secondary structural members with specified primer after fabrication. Color: Gray.
- D. Tolerances: Comply with MBMA's "Low Rise Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

2.6 STRUCTURAL FRAMING

- A. Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - 2. Slight variations in span and spacing may be acceptable if necessary, to meet manufacturer's standard, as approved by Architect.
 - 3. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
 - 4. Frame Configuration: As indicated on structural and architectural drawings.
 - 5. Exterior Column Type: Straight or tapered as indicated on structural and architectural drawings.
 - 6. Finish: Primer Gray
- B. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet pre-painted with coil coating, unless otherwise indicated, to comply with the following:
 - 1. Design and drawings of size, gage, attachment and spacing shall be provided by the pre-engineered building supplier, under the direction of an engineer, licensed in the project state.
 - 2. Finish: Primer Gray
- C. Bracing: Provide the following wind bracing where indicated on plans:
 - 1. X-bracing Rods: Reference construction documents for location and size limitations.
- D. Bolts: Provide shop-painted bolts unless structural-framing components are in direct contact with roof and wall panels. Provide zinc-plated bolts when structural-framing components are in direct contact with roof and wall panels.

2.7 ROOF PANELS (MP -2)

- A. Standing-Seam Roof Panels: A mechanically seamed trapezoidal standing seam roof panel with concealed clips. Installed directly over purlins, with thermal spacer. Tested in accordance with ASTM E 1646 and E 1680 for water penetration and air infiltration, and per ASTM E1592 for wind uplift capacity.

1. Finish: Charcoal Gray. PVDF paint finish.
 2. Gauge: 24 ga
 3. Basis of Design:
 - a. Nucor CFR Standing Seam Roof System; Vise-Lock 360°
 - b. Alliance; AS-24 (Alliance Seam 24 Panel); TripleLok Seam.
 - c. American Buildings; Standing Seam 360.
 - d. Architect approved equal.
- B. Roof Panel Accessories: Provide components required for a complete roof panel assembly including trim, copings, fasciae, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of roof panels, unless otherwise indicated.
1. Closures: Provide closures at eave and ridge, fabricated of same metal as roof panels.
 2. Clips: Minimum 0.0625-inch- thick, corrosion-resistant panel clips designed to withstand negative-load requirements. Floating to accommodate thermal movement.
 3. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch- thick, stainless-steel or nylon-coated aluminum sheet.
 4. Thermal Spacer Blocks: Where panels attach directly to purlins, provide 1-inch- thick, thermal spacer blocks; fabricated from extruded polystyrene.
 5. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

2.8 WALL PANELS

- A. Uninsulated Wall Panels: Provide manufacturer's standard panels complying with the following:
1. Ribbed Panels (**MP -1**) : Reverse-rolled wall panel with 1 1/4 inch (32mm) ribs at 12 inches (305mm) on center with semi-concealed fasteners.
 - a. Finish: Basis of Design Color is Pearl Gray (Nucor) or Tundra (Alliance). PVDF paint finish.
 - b. Gauge: 26 ga.
 - c. Basis of Design:
 - 1) Nucor; Reverse Classic
 - 2) Alliance; Reverse R-Panel
 - 3) American Buildings; Architectural III Panel
 - 4) Architect approved equal.
 2. Metal Foundation Panel (**MP-3**): Shop-fabricated metal panels.
 - a. Flat-seamed Siding: Form flat-seam panels from metal sheets, sizes as indicated, with 1/2 inch notched and folded edges.
 - b. Material: Zinc-coated (galvanized) steel sheet, 22 gage nominal thickness.
 - c. Exterior Finish: PVDF Finish: 70% PVDF paint system with a 30-year finish warranty.
 - d. Color As Selected by Architect.
 3. Interior Metal Liner Panel: Standard R-Panel profile, 36" wide.
 - a. Finish: White, polyester paint system.
 - b. Gauge: 26 ga.
- B. Wall Panel Accessories: Provide components required for a complete wall panel assembly, including trim, copings, mullions, sills, corner units, clips, seam covers, battens, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

2.9 SOFFIT PANELS

- A. Soffit Panels (**MP-4**): Reverse-rolled wall panel with 1 1/4 inch (32mm) ribs at 12 inches on center with semi-concealed fasteners. Match wall panel.
- B. Finishes: Finish panel surfaces to match adjacent panels as follows:
 1. Soffit Panels: Reference architectural drawings.
 2. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
 3. Colors, Textures, and Glosses: As selected by Architect from manufacturer's full range for these characteristics.
 4. Gauge: 26 ga.

2.10 THERMAL INSULATION

1. Basis-of-Design Product: Subject to compliance with requirements, provide Thermal Design, Inc., Simple Saver System. P.O. Box 468, 601 N. Main Street, Madison, NE 68748. ASD. Tel: (800) 255-0776 or (402) 454-6591. Fax: (402) 454-2708. Email: sales@thermaldesign.com, www.thermaldesign.com, or approved equal.
2. Simple Saver System consists of Batt Insulation, Roof Insulation, Wall Insulation, Vapor Barrier Liner Fabric, Thermal Breaks, Straps, and other devices and components in a insulation system.
 - a. Roof Insulation: Formaldehyde-free fiberglass batt or fiberglass blanket complying with ASTM C 991 Type 1 and ASTM E 84 with a thermal resistance and thickness as indicated on the drawings.
 - b. Wall Insulation: Formaldehyde-free fiberglass blanket or batt complying with ASTM C 991 Type 1, ASTM E 136 and ASTM E 84 with a thermal resistance and thickness as indicated on the drawings.
 - c. Vapor Barrier Liner Fabric: Syseal, or approved equal, type woven, reinforced, high-density polyethylene yarns coated on both sides with a continuous white or colored polyethylene coatings, as follows:
 - a. Product complies with ASTM C 1136, Types I through Type VI.
 - b. Perm rating: 0.02 for fabric and for seams in accordance with ASTM E 96.
 - c. Flame/Smoke Properties:
 - 1) 25/50 in accordance with ASTM E 84.
 - 2) Self-extinguishes with field test using matches or butane lighter.
 - d. Ultra violet radiation inhibitor to minimum UVMAX rating of 8.
 - e. Size and seaming: Manufactured in large custom pieces by extrusion welding from roll goods, and fabricated to substantially fit defined building area with minimum practicable job site sealing.
 - f. Provide with factory double, extrusion welded seams. Stapled seams or heat-melted seams are not acceptable due to degradation of fabric.
 - g. Factory-folded to allow for rapid installation.
 - h. Color:
 - 1) White.
 - d. Vapor Barrier Lap Sealant: Solvent-based, Simple Saver polyethylene fabric adhesive.

- e. Vapor Barrier Tape: Double-sided sealant tape 3/4 inch (19 mm) wide by 1/32 inch (.79 mm) thick.
- f. Vapor Barrier Patch Tape: Single-sided, adhesive backed sealant tape 3 inches (76 mm) wide made from same material as Syseal® type liner fabric.
- g. Thermal Breaks:
 - a. Wall: 1/8 inch (3 mm) thick by 3 inch (76 mm) wide white, closed-cell polyethylene foam with pre-applied adhesive film and peel-off backing.
 - b. Roof: Basis of Design: Snap-R Thermal Block by Thermal Design, or approved equal.
- h. Straps:
 - a. 100 KSI minimum yield tempered, high-tensile-strength steel.
 - b. Size: Not less than 0.020 inch (0.50 mm) thick by 1 inch (25 mm) by continuous length.
 - c. Galvanized, primed, and painted to match specified finish color on the exposed side.
 - d. Color:
 - 1) White.
 - e. High-tensile-strength stainless steel.
 - f. Woven polyester plastic. Color as selected.
- i. Fasteners:
 - a. For light gage steel: #12 by 3/4 (19 mm) inch plated Tek 2 type screws with sealing washer, painted to match specified color.
 - b. For heavy gage steel: #12 by 1-1/2 inch (38 mm) plated Tek 4 type screws with sealing washer, painted to match specified color.
 - c. For wood, concrete, other materials: As recommended by manufacturer.
- j. Wall Insulation Hangers: Fast-R preformed rigid hangers, 32 inch long galvanized steel strips with barbed arrows every 8 inches along its length.

2.11 DOORS AND FRAMES – Refer to Division 8

2.12 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer, and complying with the following:
 - 1. Provide sheet metal accessories of same material and in same finish as roof and wall panels, unless otherwise indicated.
- B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of roof or wall sheets by means of a factory-applied coating. Comply with the following:
 - 1. Fasteners for Roof and Wall Panels: Self-drilling or self-tapping 410 stainless or zinc alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of panels.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- C. Flashing and Trim: Form from 0.0179-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet pre-painted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent roof or wall panels.

1. Opening Trim: Minimum 0.028-inch- thick steel sheet. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- D. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
- E. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated. Verify color of trim with Architect's selections.

2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of metal building system.
- B. Before erection proceeds, survey elevations and locations of concrete and masonry bearing surfaces, baseplates, and anchor bolts to receive structural framing. Verify compliance with requirements and metal building system manufacturer's tolerances.

3.2 PREPARATION

- A. Clean substrates of substances, including oil, grease, rolling compounds, incompatible primers, and loose mill scale that impair bond of erection materials.
- B. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

3.3 ERECTION

- A. Erect metal building system according to manufacturer's written instructions and erection drawings.
- B. The erection of the building system shall be performed by a qualified erector, in accordance with the appropriate erection drawings, erection guides and /or other documents furnished by manufacturer, using proper tools, equipment and safety practices.
- C. Erection practices shall conform to "Common Industry Practices", Section 6, MBMA (LR)-Building Systems Manual.
- D. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

- E. Set structural framing in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- F. Baseplates and Bearing Plates: Clean concrete and masonry bearing surfaces of bond reducing materials and roughen surfaces before setting baseplates and bearing plates. Clean bottom surface of baseplates and bearing plates.
 - 1. Set baseplates and bearing plates for structural members on wedges, shims, or setting nuts.
 - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of baseplate or bearing plate before packing with grout.
 - 3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
- G. Align and adjust framing members before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Make adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
- H. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
 - 1. Make field connections using high-strength bolts. Tighten bolts by turn-of-the-nut method.
- I. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high strength bolts. Hold rigidly to a straight line by sag rods.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fascia.
 - 2. Locate and space wall girts to suit door and window arrangements and heights.
 - 3. Locate canopy framing as indicated.
 - 4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- J. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - 1. Tighten rod bracing to avoid sag.
- K. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

3.4 ROOF PANEL INSTALLATION

- A. General: Provide roof panels of full length from eave to ridge when possible. Install panels perpendicular to purlins.
 - 1. Field cutting by torch is not permitted.
 - 2. Rigidly fasten eave end of roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
 - 3. Provide weather seal under ridge cap.
 - 4. Flash and seal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 - 5. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels.

6. Use aluminum or stainless-steel fasteners for exterior applications and galvanized fasteners for interior applications.
 7. Locate and space fastenings in true vertical and horizontal alignment.
 8. Install ridge caps as roof panel work proceeds.
- B. Standing-Seam Roof Panels: Fasten roof panels to purlins with concealed clips at each standing-seam joint. Install clips over top of insulation at location and spacing determined by manufacturer.
1. Install clips to supports with self-drilling fasteners.
 2. Crimp standing seams with manufacturer-approved motorized seamer tool so clip, panel, and factory-applied side-lap sealant are completely engaged.

3.5 WALL PANEL INSTALLATION

- A. General: Provide panels full height of building when possible. Install panels perpendicular to girts.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Install panels with vertical edges plumb. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 2. Unless otherwise indicated, begin panel installation at corners with center of rib lined up with line of framing.
 3. Field cutting by torch or abrasion is not permitted. Field cutting by shear tools only.
 4. Align bottom of wall panels and fasten with blind rivets, bolts, or self-tapping screws.
 5. Fasten flashing and trim around openings and similar elements with self-tapping screws.
 6. When two rows of panels are required, lap panels 4 inches minimum. Locate panel splices over structural supports.
 7. When building height requires two rows of panels at gable ends, align lap of gable panels over wall panels at eave height.
 8. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 9. Provide weather-resistant escutcheons for pipe and conduit penetrating exterior walls.
 10. Flash and seal wall panels with weather closures under eaves and rakes, along lower panel edges, and at perimeter of all openings.
 11. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as necessary for waterproofing. Handle and apply sealant and backup according to sealant manufacturer's written instructions.
 12. Use aluminum or stainless-steel fasteners for exterior applications and galvanized fasteners for interior applications.
 13. Locate and space fastenings in true vertical and horizontal alignment.

3.6 SOFFIT PANEL INSTALLATION

- A. General: Provide panels full width of fascia and soffits. Install panels perpendicular to support framing.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Install panels with vertical edges plumb. Lap ribbed or fluted panels one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 2. Field cutting by torch is not permitted.

3. Fasten flashing and trim around openings and similar elements with self-tapping screws.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Use aluminum or stainless-steel fasteners for exterior applications and galvanized fasteners for interior applications.
 6. Locate and space fastenings in true vertical and horizontal alignment.
- B. Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- C. Soffit Panels: Flash and seal panels with weather closures where soffit meets walls and at perimeter of all openings.

3.7 ACCESSORY INSTALLATION

- A. General: Install ventilators and other accessories according to manufacturer's written instructions, with positive anchorage to building and weathertight mounting. Coordinate installation with flashings and other components.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide for thermal expansion of metal units; conceal 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 excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
 3. Separations: Separate metal from incompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

3.8 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
1. Install pre-engineered building insulation system in accordance with manufacturer's installation instructions and the approved shop drawings.
 2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
 3. Install in exterior spaces without gaps or voids. Do not compress insulation.
 4. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
 5. Fit insulation tight in spaces and tight to exterior side of the sealed liner fabric and around mechanical and electrical services within plane of insulation.
- B. Roof Insulation Installation:
1. Straps:

- a. Cut straps to length and install in the pattern and spacings indicated on shop drawings.
 - b. Tension straps to required value.
2. Vapor Barrier Fabric:
- a. Install vapor barrier fabric in large one-piece custom fabricated pieces to substantially fit defined building areas with minimum practicable job site sealing.
 - b. Position pre-folded fabric on the strap platform along one eave purlin.
 - c. Clamp the two bottom corners at the eave and also centered on the bay.
 - d. Pull the other end of the pleat-folded fabric across the building width on the strap platform, pausing only at the ridge to fasten the straps and fabric in position where plane of roof changes and to release temporary fasteners on

the opposite ridge purlins.
 - e. Once positioned, install fasteners from the bottom side at each strap/purlins intersection.
 - f. Trim edges and seal along the rafters.
 - g. All seams must be completely sealed and stapled seams not acceptable.
3. Insulation:
- a. Unpack, and shake to a thickness exceeding the specified thickness.
 - b. Ensure that cavities are filled completely with insulation.
 - c. Place on the vapor barrier liner fabric without voids or gaps.
 - d. Place top layer of insulation over and perpendicular to the purlins without voids or gaps, as roof sheathing is applied.
 - e. Place thermal block on top of purlins or bottom of purlins for retrofit work, if no other thermal break exists.
 - f. Place new insulation between purlins at the required thickness for the R-value specified.
 - g. Seal vapor barrier fabric to the wall fabric and elsewhere as required to provide a continuous vapor barrier.

C. WALL INSULATION INSTALLATION

1. Insulation:
- a. Install thermal break to exterior surface of girts as wall sheathing is applied.
 - b. Install self-sticking foam thermal break to interior surface of girts prior to installation of insulation.
 - c. Position and secure Fast-R hangers to girts on the inside face of the wall sheathing.
 - d. Cut insulation to required lengths to fit vertically between girts.
 - e. Fluff the insulation to the full-specified thickness.
 - f. Neatly position in place and secure to Fast-R hangers.
 - g. Ensure that cavities are filled completely with insulation.
2. Vapor Barrier Fabric:
- a. Install vapor barrier fabric in large one-piece custom fabricated pieces to substantially fit defined building areas with minimum practicable job site sealing.
 - b. Apply the vapor barrier fabric by clamping it in position over eave strap and installing fasteners through the eave strap into each roof strap, permanently clamping the wall fabric between them.
 - c. Once in position, draw the vapor barrier fabric down over the column flanges to the base angle and install vertical straps along each column and 5 feet 0 inches on center, maximum, fastening to each girt to retain system permanently in place.
 - d. All seams must be completely sealed and stapled seams not acceptable.

3. Seal wall fabric to the roof fabric, to the base angle and up the columns to provide a continuous vapor barrier.

3.9 ERECTION AND LOCATION TOLERANCES

- A. Structural-Steel Erection Tolerances: Comply with erection tolerance limits of AISC S303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Roof Panel Installation Tolerances: Shim and align 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.
- C. Wall Panel Installation Tolerances: Shim and align units within installed tolerance of 1/4 inch in 20 feet on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- D. Door Installation Tolerances: Fit doors in frames within clearances specified in SDI 100.

3.10 ADJUSTING

- A. Doors: After completing installation, lubricate, test, and adjust doors to operate easily, free from warp, twist, or distortion.
- B. Ventilators: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily, free from warp, twist, or distortion.

3.11 CLEANING AND PROTECTION

- A. Touchup Painting: Immediately after erection, clean, prepare, and prime or re-prime welds, bolted connections, and abraded surfaces of prime-painted primary and secondary framing, accessories, and bearing plates.
 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 2. Apply compatible primer of same type as shop primer used on adjacent surfaces.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded surfaces of shop-painted primary and secondary framing, accessories, and bearing plates are included in Division 9 Section "Painting."
- C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- D. Roof and Wall Panels: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in a clean condition during construction.
 1. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- E. Doors: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
 1. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

**SECTION 220100
PLUMBING GENERAL REQUIREMENTS**

PART 1 - GENERAL

1.01 APPLICABILITY

- A. The work covered by the Division of the Specifications consists of providing all labor, supervision, equipment, materials, all incidentals, related items and appurtenances, and performing all operations necessary to complete the installation of work in strict accordance with these specifications and drawings.
- B. All work shall be finished, tested, and ready for operation. The word "Provide" shall mean "furnish and install complete and ready for use".

1.02 DRAWINGS:

- A. The drawings indicate the extent and general layout of the mechanical systems intended for the building. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, connections, and accessories which may be required. Provide offsets, fittings, valves, and accessories as may be required, to produce a complete and operating installation of type shown and specified.
- B. Mechanical drawings are diagrammatic in nature and should not be scaled to obtain dimensions. Obtain dimensions and locations of partitions, walls, etc., from the Architectural dimensioned drawings. Consult the Architectural drawings for details of construction, location of suspended ceilings, ceiling heights, and other pertinent information. Architect's drawings shall not take precedence over field measurements.
- C. All drawings and specifications shall be considered in bidding. The drawings and specifications are complimentary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict arise between drawings and specifications, such conflict shall be brought to the attention of the Architect.

1.03 SUBMITTALS

- A. All submittals to be reviewed, approved, and stamped by submitting contractor prior to submittal to engineer. Submittals not reviewed by submitting contractor prior to submittal to engineer will be returned marked "Not Reviewed".

1.04 APPROVED MANUFACTURERS

- A. Where approved manufacturers are indicated in the specifications, the approval does not relieve the responsibility of the contractor to provide products and systems which meet the requirements of the specifications and drawings.
- B. Performance, dimensions, electrical requirements, and functions shall be coordinated with the basis of design indicated on the drawings and in the specifications. If there are differences from the basis of design they should be brought to the attention of the Engineer.
- C. Revisions required by the differences from basis of design, shall be provided to the Owner without additional cost. Revisions to the work of other contractors on the project, due to differences in equipment, shall be provided by the contractor supplying the equipment at no additional cost to the Owner.

1.05 INSTRUCTION OF OWNER'S EMPLOYEES:

- A. Provide, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment, and operation of all parts of the mechanical equipment to the Owner's employees who are to have charge of the equipment.
- B. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.
- C. Hours of instruction shall be divided up into a minimum of two (2) instruction periods. Provide a minimum of four (4) total hours of training for plumbing equipment and systems.

1.06 INSTALLATION OF EQUIPMENT:

- A. All appliances and equipment shall be installed and connected in accordance with manufacturer's instructions and recommendations unless such instructions are in conflict with these specifications.
- B. All equipment shall be installed in such a manner and location as to facilitate accessibility for maintenance and/or replacement.

1.07 COOPERATION WITH OTHER TRADES:

- A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom, the Contractor shall off-set the piping and/or re-route the duct work where directed by the Engineer. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

1.08 INSPECTION OF SITE:

- A. Before submitting a proposal on the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize himself with all of the existing conditions and limitations. No extras will be allowed because of Contractor's misunderstanding as to the amount of work involved or lack of his knowledge of any condition in connection with the new construction.

1.09 CODES, ORDINANCES, REGULATIONS, & STANDARDS:

- A. The entire installation shall be made in accordance with all state and local laws. If, in any instance, the plans and specifications conflict with such laws, the law shall take precedence. This, however, shall not be construed as relieving the contractor from complying with any requirements of the drawings and specifications that may be in excess of the rules and not contrary to the same.
- B. All work shall conform to applicable state and local codes, ordinances, regulations, and/or standards.

1.10 PERMITS, LICENSES AND FEES

- A. The contractor shall secure and pay for all the associated permits, fees, licenses and inspections by government agencies necessary for proper execution and completion of the work that are customarily secured after execution of the contract and legally required at the time bids are received or negotiations concluded.

1.11 CONTRACTOR WARRANTIES

- A. Contractor shall guarantee all equipment, materials, and workmanship for a period of one year from the date of final completion. Any defects in equipment, materials or workmanship that appear or cause any issues within the one year period shall be repaired at no additional cost, (this shall include materials and labor). Refer to all other specification sections for additional guarantees/warranties requirements.

PART 2 - PRODUCTS

2.01 OPERATION & MAINTENANCE MANUALS

- A. Contractor to provide Operation and Maintenance manuals to meet all requirements detailed by this section in addition to all requirements defined in Section 01 of this manual.
- B. Manuals shall be bound in new 3 ring binders, 2" D-ring, black color, with the title "Operations and Maintenance Manual" and the project title and volume number clearly printed on the front cover and spine of the binders.
- C. Manual shall include an index in the front of each manual for the sections included in the manual. Each section shall be referenced with plastic tabs.
- D. Include in the front of each manual a complete listing of all mechanical contractors and sub-contractors used on the project. Include names, addresses and phone numbers for each

contracted listed.

- E. Manuals shall be arranged by specification number. Each piece of equipment shall be referenced by tag number with tabs. At the beginning of each section, the equipment supplier's name, address and phone number shall be provided.
- F. Data for equipment included in the manuals:
 - 1. Approved shop drawings clearly showing the models, sizes and capacities of equipment used. All shop drawings included in the manual shall have all review comments addressed.
 - 2. Operations Manuals detailing step by step procedures for putting equipment into operation.
 - 3. Maintenance Manuals from the manufacturer of each piece of equipment including instructions for installation, maintenance and lubrication. Manuals shall include parts lists for all replacement parts.
 - 4. All equipment warranty information with warranty registration completed in owners name.
- G. Include the following reports in the manuals:
 - 1. Testing and balancing reports for air and water systems as specified.
 - 2. Start-up reports.
 - 3. Valve and damper tag lists.
- H. Submit one hard copy of the Operation & Maintenance Manuals to the Engineer and the Contracting Officer for approval prior to delivery to the Owner.

2.02 SUB-BASES FOR EQUIPMENT:

- A. Sub-bases shall be provided for all equipment such as water heaters, pumps, and air compressors. Each electric motor shall be mounted on the same sub-base as the driven machine.
- B. Sub-bases generally consist of pads constructed of 2500 psi concrete with all exposed surfaces finished with cement mortar, troweled smooth. Machines other than those supported on isolation units shall be secured to concrete sub-bases with anchor bolts of ample size. All machines having bed plates and flexible and solidly connected motors shall be grouted under the full area of the bed plates with a non-shrinking, premixed grout. After grout has set, all wedges, shims, and jack bolts shall be removed and spaces filled with grout.
- C. Premanufactured rooftop curbs and/or supports for any roof mounted item supplied under this division of the specifications shall be provided by the Mechanical Contractor. Sizes, locations, and installation shall be coordinated with the Roofing Contractor.

2.03 SUPPORTING STEEL, ROOF AND WALL OPENINGS:

- A. Provide structural steel framework for supporting mechanical equipment as required.
- B. Unless otherwise indicated by the drawings, lintels for new mechanical openings shall be provided by the contractor installing the pipe.
- C. Unless otherwise indicated by the drawings, angles to frame a new roof opening through the roof deck shall be provided by the contractor installing the pipe through the roof.
- D. All steel work shall be in conformance with the requirement of the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings. Material shall conform to ASTM A36.

2.04 SLEAVES, CUTTING, AND CORE DRILLING:

- A. Provide sleeves for piping openings in masonry walls.
- B. The contractor shall saw cut or core drill existing masonry floors and walls for new piping penetrations. The contractor shall cut new openings through framed walls for piping penetrations. Provide headers as needed in frame walls.

2.05 FIRESTOPPING

- A. Provide firestopping assemblies for the required fire ratings and listed in the current year certification books of UL, FM or ITS (Warnock Hersey).
- B. See the Architectural drawings for required ratings. Refer to the Mechanical drawings for additional ratings. Provide firestopping for all penetrations of these assemblies.

2.06 SEALING PENETRATIONS IN NON-RATED WALLS AND FLOORS

- A. Provide caulk at penetrations of non-rated walls and floors for piping. If the gap is too large for caulk, provide fiberglass insulation for backing. Conceal the fiberglass with either caulk or sheetmetal. Refer to specifications for sleeve requirements.
- B. In mechanical rooms and other water-proof floor areas, provide sleeves or concrete pads at least 2" higher than the top of slab to prevent water from running through the annular space between the pipe and the floor opening. In addition to the sleeve, provide packing and caulking around the pipe inside the sleeve to prevent noise transmission through openings in the floor.

2.07 ACCESS DOORS IN CEILINGS AND WALLS

- A. Provide metal lockable access doors in gypsum board ceilings and walls where needed for access to dampers or valves. Coordinate the installation of the access doors with the ceiling contractor. Confirm the location of the panels with the Architect. Provide rated doors where required, refer to architects plans for rated walls/ceilings.

2.08 TRENCHING, BACKFILL AND COMPACTION

- A. Provide trenching, backfill and compaction for buried plumbing systems. Refer to Divisions 1 and 31 specifications for requirements.
- B. As a minimum requirement, the fill shall be either subsoil excavated on-site or engineered fill. The fill shall be free of lumps larger than 3 inches, rocks larger than 2 inches, frozen or spongy and wet material not capable of compaction in place.

PART 3 - EXECUTION

3.01 FIRESTOPPING INSTALLATION

- A. Verify openings are ready to receive the firestopping. Modify the openings as required to accommodate the requirements for the certified assembly drawing for the firestopping material.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- C. Remove incompatible materials that could adversely affect bond.

3.02 TRENCHING, BACKFILL AND COMPACTION

- A. Refer to Divisions 1 and 31 specifications for requirements.
- B. Compact to minimum of 95 percent of maximum dry density. Cut out soft areas and backfill. Do not fill with frozen materials. Place and compact in layers not exceeding 8 inches compacted depth. Correct areas that are over-excavated. Maintain moisture content of fill materials to obtain compaction density.

END OF SECTION

**SECTION 220553
PLUMBING IDENTIFICATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

1.02 SUBMITTALS

- A. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Piping: Pipe Markers or Stencils.
- B. Pumps: Nameplates.
- C. Small-sized Equipment: Tags.
- D. Tanks: Nameplates.
- E. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.03 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- B. Chart: Typewritten letter size list framed behind glass and secured to the wall. Either a floor plan of the building indicating location of valve or describe location by room number, etc. Also include description of service and duty of valve, unless obvious from location on the floor plan.

2.04 PIPE MARKERS

- A. 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.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install plastic 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. Identify valves in main and branch piping with tags.

- E. Identify piping, concealed above the ceiling or exposed within equipment rooms and tunnels, with stencilled painting. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet 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.

3.03 IDENTIFICATION SCHEDULES

- A. Chart: Submit valve chart, including valve tag number, location, function, and valve manufacturer's name and model number. Locate valve chart in mechanical room.
- B. Plumbing Systems
 - 1. Domestic Hot Water
 - a. Pipe Markers
 - 2. Domestic Cold Water
 - a. Pipe Markers
 - 3. Recirculating Hot Water
 - a. Pipe Markers
 - 4. Propane Gas Piping
 - a. Pipe Markers
 - 5. Sanitary Drain
 - a. Pipe Markers
 - 6. Storm Drain
 - a. Pipe Markers
 - 7. System Main Shut-off Valves
 - a. Brass Identification Tag
 - 8. Balancing Valves
 - a. Brass Identification Tag
- C. Equipment
 - 1. In-Line Pumps
 - a. Nameplate
 - 2. Water Heater
 - a. Nameplate

END OF SECTION

**SECTION 220719
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.02 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.
- B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 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

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER

- A. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 650 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- B. 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.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. 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.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETS

- A. PVC Plastic.
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 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. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. 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.
- I. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches 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 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.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.03 SCHEDULES

- A. Plumbing Systems:
 1. Domestic Hot Water Supply:
 - a. Glass Fiber Insulation:
 - 1) 1-1/4" and less: 1 inch
 - 2) 1 1/2" to 3": 1 1/2 inch
 - 3) 4" and larger: 1 1/2 inch
 2. Domestic Hot Water Recirculation:
 - a. Glass Fiber Insulation:
 - 1) 1-1/4" and less: 1 inch
 - 2) 1 1/2" to 3": 1 1/2 inch
 - 3) 4" and larger: 1 1/2 inch
 3. Domestic Cold Water:
 - a. Glass Fiber Insulation:
 - 1) 1-1/4" and less: 1 inch
 - 2) 1 1/2" to 3": 1 1/2 inch
 - 3) 4" and larger: 1 1/2 inch
 4. Roof Drain Bodies:
 - a. Glass Fiber Insulation:
 - 1) All sizes: 1 inch
 5. Rain Leaders Above Grade:
 - a. Glass Fiber Insulation:
 - 1) All sizes: 1 inch
 6. Rain Leaders Within 10 Feet of the Floor:
 - a. Glass Fiber Insulation with PVC jacket:
 - 1) All sizes: 1 inch
 7. Plumbing Vents Within 10 Feet of the Exterior:
 - a. Glass Fiber Insulation:
 - 1) All sizes: 1 inch
 8. Condensate Drains from Cooling Coils:
 - a. Glass Fiber or Flexible Elastomeric:
 - 1) All sizes: 1 inch
 9. Above Ground Drains Receiving Condensate From Drain to Sanitary Main:
 - a. Glass Fiber:
 - 1) All sizes: 1/2 inch

END OF SECTION

**SECTION 221005
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Storm water.
 - 4. Gas.
 - 5. Equipment drains and overflows.
 - 6. Flanges, unions, and couplings.
 - 7. Valves.
 - 8. Flow controls.

1.02 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- D. ASME B31.1 - Power Piping; 2018.
- E. ASME B31.9 - Building Services Piping; 2017.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- H. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- J. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2019.
- K. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012 (Reapproved 2018).
- L. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
- M. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2014.
- N. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2015.
- O. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.
- P. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.
- Q. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).
- R. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2017 (Revised 2018).
- S. 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; 2012 (Revised 2018).

- T. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.
- U. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- V. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
- W. NSF 61 - Drinking Water System Components - Health Effects; 2020.
- X. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
 - 1. Provide submittal for recirc valves showing size and temperature selection.
- B. Project Record Documents: Record actual locations of valves.

1.04 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.06 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 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.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D 2665
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Tubing, Type K for sizes 2" inch and smaller.
 - 1. Joints: None allowed under building.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: Ductile or gray iron, standard thickness. Wrap with 10 mil polyethylene jacket.
 - 2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.
 - 3. Jackets: AWWA C105 10 mil polyethylene jacket
- C. Option pending plumbing inspector approval:

1. Where the local plumbing authority approves AWWA C900 PVC piping may be used for underground water service. The PVC pipe shall terminate inside the basement wall or above the building floor with a flange. Piping downstream of that flange shall be copper or ductile iron.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H) is approved for all pipe sizes. Type M hard drawn copper tube is approved for pipe sizes 2" and larger.
 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 2. Joints: Solder, lead free, 95-5 tin-antimony, or tin and silver.
 3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 4. Mechanical Press Sealed Fittings: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of ASME B16.51 and IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer.

2.06 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D 2665.
 1. Fittings: PVC.
 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 1. Fittings: Cast iron.
 2. Joints: Heavy duty hubless couplings conforming to ASTM 1540. Provide a minimum of 4 bands on pipe 4 inch and smaller and a minimum of 6 bands on pipe 5 inch and larger.
 - a. Joint Manufacturers:
 - 1) Husky.
 - 2) Mission.

2.08 EQUIPMENT DRAINS AND OVERFLOWS

- A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), 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 B 32 lead-free solder, alloy Sn95 solder.
- B. PIPE SIZES SHOWN ON PLANS ARE MINIMUM REQUIRED PIPE SIZES. CONTRACTOR SHALL UPSIZE PIPING TO MATCH DRAIN PAN CONNECTION AS REQUIRED. CONDENSATE PIPING SHALL NOT BE DOWNSIZED FROM DRAIN PAN CONNECTION TO DRAIN.

2.09 PROPANE GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. Polyethylene Pipe: ASTM D2513, SDR 11.
 1. Fittings: ASTM D2683 or ASTM D2513 socket type.
 2. Joints: Fusion welded.

2.10 PROPANE GAS PIPING, BURIED

- A. Polyethylene Pipe: ASTM D 2513, SDR 11.
 1. Fittings: ASTM D 2683 or ASTM D 2513 socket type.
 2. Joints: Fusion welded.
 3. Tracer Wire: Install yellow insulated tracer wire adjacent to piping. Terminate tracer wire above ground at each end of piping. Tracer wire shall be a of 18 AWG and the insulation shall be rated for direct bury.

2.11 PROPANE 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: NFPA 58, threaded or welded to ASME B31.1.
- B. Mechanical Press Sealed Fittings: Double pressed type, CSA certified and ICC listed for fuel gas service, utilizing HNBR sealing elements. The fittings shall have a marking with color to indicate gas service and a CSA label. The fittings shall have a connection feature assuring leakage of gases during testing of any unpressed connection.
1. Manufacturers:
 - a. Viega LLC: www.viega.com.
- C. Provide dead end lock-up type gas pressure regulators on each line serving gravity type equipment, sized in accordance with equipment.
1. Pipe regulator vent to the exterior. Regulators with vent limiting device are acceptable in well ventilated spaces.

2.12 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches 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 Size Over 1 Inch:
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. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.13 BALL VALVES

- A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
 2. Nibco, Inc: www.nibco.com
 3. Viega LLC: www.viega.us
 4. Milwaukee.
 5. Stockham
 6. Jomar
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle solder, threaded or grooved ends with union.

2.14 THERMOSTATIC RECIRCULATION VALVES

- A. Manufacturers:
1. Therm-Omega-Tech model CSUA.
 2. B&G Temp Setter.
- B. Construction: Stainless steel body and internal components certified to NSF/ANSI 61 for Drinking Water System Components. Spring operated, thermostatically actuated controlled recirculation valve for domestic hot water piping. The valve shall be self-contained and fully automatic with unions and isolation valves. Contractors option to provide recirculation valve with field installed union and isolation valves.
- C. Valves shall be line size with 115 degrees F temperature setpoint.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 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.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Provide access panels where valves and fittings are not exposed. Coordinate with general contractor.
- D. PVC solvent welded joints shall be made using a primer of contrasting color.
- E. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- F. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- G. Group piping whenever practical at common elevations.
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- J. Provide handle stand-off extensions on valves to provide a minimum of 3/4" clearance between valve handle and piping insulation.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- L. Install bell and spigot pipe with bell end upstream.
- M. Install valves with stems upright or horizontal, not inverted.
- N. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood. Where code allows vent limiting devices, they may be used in lieu of venting the regulator to the outdoors.
- O. Provide primer and exterior paint of color selected by the Architect on all gas piping and devices outside the building.
- P. Install water piping to ASME B31.9.
- Q. Gas piping shall be installed and tested in accordance with local codes and NFPA, but in no case less than 25 psig air test for thirty minutes at the completion of the work.
- R. Provide gas main shut-off valve before the first branch line. Shut-off valve shall be installed inside the building at 5 feet or less above the floor.
- S. All required gas pressure regulators to be installed no more than 5 equivalent feet from equipment connection. Piping from regulator to equipment connection to be equipment connection size. Where regulator cannot be installed within 5 equivalent feet from equipment connection, contact engineer for pipe sizing.
- T. Buried gas piping. Install yellow insulated tracer wire adjacent to piping. Terminate tracer wire above ground at each end of piping. Tracer wire shall be a of 18 AWG and the insulation shall be rated for direct bury.
- U. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- V. Press connections: copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.
- W. Inserts:

1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- X. Pipe Hangers and Supports:
1. Install in accordance with MSS SP-58 and local code requirements.
 2. Hanger spacing and application shall be in accordance with MSS SP-69 and local code requirements.
 3. Provide oversized hangers on insulated pipe to allow insulation at full thickness to be provided on the piping.
 4. Support horizontal piping as required by code.
 5. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 6. Place hangers within 12 inches of each horizontal elbow.
 7. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 8. Support vertical piping at every floor and as required by code. Support riser piping independently of connected horizontal piping.
 9. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 10. Provide copper plated hangers and supports for copper piping.
 11. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 12. Support cast iron drainage piping at every joint.
 13. Provide hangers and supports as required by local code and authority having jurisdiction.

3.04 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.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope for pipes. Only where site conditions preclude this slope, pipes 4" and larger may be sloped at 1/8 inch per foot where first approved by the Authority Having Jurisdiction.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with the Plumbing Code.

3.07 PRESSURE TESTING OF PLUMBING PIPING SYSTEMS

- A. Pressure test all plumbing piping systems in accordance with the Plumbing and Fuel Gas Code.

3.08 SERVICE CONNECTIONS

- A. Provide new sanitary and storm 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 water meter with by-pass valves, and sand strainer.

END OF SECTION

**SECTION 221006
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Trench drains.
- C. Water meter
- D. Cleanouts.
- E. Hose bibbs.
- F. Hydrants.
- G. Refrigerator valve and recessed box.
- H. Water hammer arrestors.
- I. Sand/Oil Interceptors

1.02 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor and Trench Drains; 2019.
- B. NSF 61 - Drinking Water System Components - Health Effects; 2020.
- C. NSF 372 - Drinking Water System Components - Lead Content; 2016.
- D. PDI-WH 201 - Water Hammer Arresters; 2017.

1.03 SUBMITTALS

- A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

1.06 EXTRA MATERIALS

- A. Supply for Owner's use in maintenance of project:
 - 1. Two loose keys for outside hose bibbs.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 2. Josam Company: www.josam.com.
 - 3. Wade: www.wadedrains.com.
 - 4. Watts: www.watts.com.
 - 5. Zurn Industries, LLC: www.zurn.com/#sle.
 - 6. Mifab
- B. Roof Drain (RD-1):
 - 1. Model: Zurn Z100.

2. Assembly: ASME A112.6.4.
 3. Description: Cast iron body with membrane flashing clamp, gravel guard, and cast iron dome strainer and underdeck clamp.
- C. Roof Drain (ORD-1):
1. Model: Zurn Z100.
 2. Assembly: ASME A112.6.4.
 3. Description: Cast iron body with membrane flashing clamp, gravel guard, and cast iron dome strainer and underdeck clamp. Provide with 2" external water dam.
- D. Downspout Nozzle (DS-1):
1. Model: Zurn Z199
 2. Description: Downspout nozzle, all nickel bronze body, and decorative face of wall flange and outlet nozzle
- E. Floor Drain (FD-1):
1. Model: Zurn Z415.
 2. Description: Cast iron body with bottom outlet, combination invertible membrane clamp, adjustable collar, and seepage slots. Provide with polished nickel bronze strainer.
- F. Floor Drain (FD-2)
1. Zurn Z415I.
 2. Description: Cast iron body with bottom outlet, combination invertible membrane clamp, adjustable collar, and seepage slots. Provide with polished nickel bronze strainer with raised flange. Install so top of raised flange is even with the finished floor and the strainer is recessed below the floor.
- G. TRENCH DRAINS
1. Manufacturers:
 - a. Zurn
 - b. MiFab
 2. Trench Drain (TD-1):
 - a. Model: Zurn 886-HD
 - b. Description: Heavy duty, 6" wide pre-sloped drainage system constructed of high density polyethylene structural composite drain channel with 0.75% bottom slope. All modular section to have integral top frame, interlocking ends, and radiuses bottom. Trench drain to have combination tie down/leveling devices.
 - c. Grate: Load Class E, slotted ductile iron.

2.03 WATER METER

- A. Provide a water meter with a pressure drop of less than 4 psi at 47 gpm.
- B. Provide a remote reader for the water meter. Coordinate location of remote reader location with Architect.
- C. Contractor is required to contact local water department for water meter requirements including all valving requirements.

2.04 CLEANOUTS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 2. Josam Company: www.josam.com.
 3. Wade: www.wadedrains.com.
 4. Watts: www.watts.com.
 5. Zurn Industries, LLC: www.zurn.com.
- B. Cleanout (CO):
 1. Model: Zurn ZN1400.
 2. Description: Adjustable floor cleanout, cast iron body.
 3. Cover: Round, Polished Nickel Bronze finish.

- C. Cleanout (WCO):
 - 1. Model: Zurn Z1446.
 - 2. Description: Wall cleanout, cast iron body.
 - 3. Cover: Round, smooth stainless steel wall access cover.

2.05 HOSE BIBBS

- A. Manufacturers:
 - 1. Chicago.
 - 2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
 - 3. Watts Regulator Company: www.wattsregulator.com.
 - 4. Woodford.
 - 5. Zurn Industries, Inc: www.zurn.com.
 - 6. Wade
- B. Hose Bibb (HB-1):
 - 1. Model: Zurn Z1341-BFP.
 - 2. Description: Brass construction with chrome finish and metal wheel handle. Provide integral backflow preventer.

2.06 HYDRANTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
 - 2. Watts.
 - 3. Woodford.
 - 4. Zurn Industries, LLC: www.zurn.com/#sle.
 - 5. Hoepfner Products
 - 6. Wade
- B. Wall Hydrant (WHY-1):
 - 1. Model: Zurn Z1321-C.
 - 2. Description: Anti-siphon, bronze construction, automatic draining, non freeze wall hydrant. Provide integral backflow preventer and stainless steel face with operating key.

2.07 REFRIGERATOR ICE MAKER BOXES AND VALVES

- A. Ice Maker Trim (IMT)
 - 1. Description: Plastic preformed rough-in box with brass 1/4 turn valves, slip in finishing cover with braided stainless steel supply line. Provide fire-rated box when located in rated walls. Refer to architects plan for rated wall locations.

2.08 WATER HAMMER ARRESTORS

- A. Water Hammer Arrestors:
 - 1. Copper construction, bellows or piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure. ASSE 1010 certified water hammer arrestor, designed or provide continuous protection with maintenance.
 - 2. Provide size and quantity of water hammer arrestors as recommended by manufacturer for the plumbing fixtures it is serving.

2.09 SAND/OIL INTERCEPTORS

- A. Manufacturers:
 - 1. Striem
 - 2. Or approved equal prior to bids
- B. Sand/Oil Interceptors:
 - 1. Construction:
 - a. High density polyethylene with minimum 3/8" uniform wall thickness. Designed for below grade installation. Designed to meet the requirements of UPC 1017 with

internal flow control, built in test caps and multiple outlet options.

2. Cover:
 - a. Traffic rated gasket composite or steel cover, H2O rated.
 3. Accessories:
 - a. Provide with fully adjustable risers.
 - b. Provide with multiple anchor points for anchoring to concrete dead man blocks.
Provide with high water anchor kits.
 4. Sand Oil Interceptor (S/O-1)
 - a. Model: Striem OS-75
 - b. Capacity: 110 holding gallons, 75 gpm flow rate, Sand Capacity of 11 gallons and Oil capacity of 27.5 gallons.
- C. Contractor to provide concrete deadman footing blocks or concrete slab for anchoring of sand/oil interceptor below grade. Coordinate quantity and sizes of deadman anchors with sand/oil interceptor manufacturer and provide accordingly.

PART 3 EXECUTION

3.01 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. Install floor cleanouts at elevation to accommodate finished floor.
- D. Install water hammer arrestors complete with accessible isolation valve on cold water piping to each group of fixtures (washroom).

END OF SECTION

**SECTION 223000
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water Heaters:
 - 1. Residential electric.
- B. Diaphragm-type compression tanks.
- C. In-line circulator pumps.

1.02 SUBMITTALS

- A. Product Data:
- 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.

1.03 QUALITY ASSURANCE

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.05 WARRANTY

- A. Provide three year manufacturer warranty for commercial domestic water heaters.
- B. Provide one year manufacturer warranty for residential domestic water heaters, installed in commercial applications.

PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
 - 2. Bradford White/Laars
 - 3. Lochinvar
 - 4. PVI
 - 5. State
- B. Residential Electric:
 - 1. Type: Automatic, electric, vertical storage.
 - 2. Performance: See Drawings.
 - 3. Tank: Glass lined welded steel, thermally insulated with one inch thick foam plastic; encased in corrosion-resistant steel jacket; baked-on enamel finish.
 - 4. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box. Wire double element units so elements do not operate simultaneously.
 - 5. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Crosslink polyethylene (PEX).
 - c. Drain valve.
 - d. Anode: Aluminum with steel core.
 - e. Temperature and Pressure Relief Valve: ASME labeled.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Manufacturers:
 - 1. Amtrol Inc: www.amtrol.com.

2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
 3. Taco, Inc: www.taco-hvac.com/#sle.
 4. Watts Regulator
 5. American Wheatly
 6. Elbi
- B. Construction: Welded steel rated for working pressure of 125 psig, with flexible butyl rubber EPDM diaphragm sealed into tank, and steel legs or saddles, Watts Model PLT-20 or equivalent.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

2.03 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
1. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
 2. Taco.
 3. Grundfos
- B. Casing: Bronze, rated for 150 psi working pressure, with stainless steel rotor assembly.
- C. Impeller: non-ferrous.
- D. Shaft: Ceramic.
- E. Bearings: Double-sintered carbon.
- F. Seal: Carbon rotating against a stationary ceramic seat.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

END OF SECTION

**SECTION 224000
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water closets.
- B. Lavatories.
- C. Sinks.
- D. Service sinks.

1.02 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings; 2018.
- B. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018.
- C. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2017.
- D. NSF 61 - Drinking Water System Components - Health Effects; 2020.
- E. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.03 SUBMITTALS

- A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- B. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Faucet Washers: One set of each type and size.
 - 2. Extra Shower Heads: One of each type and size.
 - 3. Extra Toilet Seats: One of each type and size.
 - 4. Flush Valve Service Kits: One for each type and size.

1.04 QUALITY ASSURANCE

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

1.05 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

2.01 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.

2.02 FLUSH VALVE WATER CLOSETS

- A. Water Closet Manufacturers:
 - 1. American Standard Inc: www.americanstandard.com.
 - 2. Sloan
 - 3. Zurn industries, Inc: www.zurn.com
 - 4. Kohler Company: www.kohlerco.com.
 - 5. Vitra: www.vitra-usa.com.
- B. Water Closet (WC-1):
 - 1. Model: American Standard 3043.001.
 - 2. Description: ADA compliant, vitreous china, 1.6 gpf, floor-mounted elongated bowl, 1 1/2 inch top spud water closet.

3. Mounting height: 17 inches from finished floor to rim.
 4. Water Supply: 1 inch cold water connection.
 5. Flush Valve: Exposed Manual
 - a. Model: Sloan 111
 - b. Description: Exposed chrome plated, diaphragm type with oscillating handle, integral screwdriver stop, vandal resistant stop cover and vacuum breaker; maximum 1.6 gallon flush volume.
- C. Water Closet (WC-2):
1. Model: American Standard 2234.001.
 2. Description: Vitreous china, 1.6 gpf, floor-mounted elongated bowl, 1 1/2 inch top spud water closet.
 3. Mounting height: 14 1/8 inches from finished floor to rim.
 4. Water Supply: 1 inch cold water connection.
 5. Flush Valve: Exposed Manual
 - a. Model: Sloan 111
 - b. Description: Exposed chrome plated, diaphragm type with oscillating handle, integral screwdriver stop, vandal resistant stop cover and vacuum breaker; maximum 1.6 gallon flush volume.
- D. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Manufacturers:
 - a. Delany Products: www.delanyproducts.com/#sle.
 - b. Sloan Valve Company: www.sloanvalve.com/#sle.
 - c. Zurn Industries, Inc: www.zurn.com/#sle.
 - d. American Standard, Inc: www.americanstandard-us.com
- E. Seats:
1. Manufacturers:
 - a. Bemis Manufacturing Company: www.bemismfg.com.
 - b. Church Seat Company: www.churchseats.com.
 - c. Olsonite: www.olsonite.com.
 - d. Zurn Industries, Inc: www.zurn.com.
 - e. Centoco: www.centoco.com.
 - f. Beneke: www.sppi.com
 2. Solid white plastic, elongated, open front, extended back, self-sustaining hinge, brass bolts, without cover.
- F. Refer to architects elevation for mounting height.

2.03 LAVATORIES

- A. Lavatory Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com.
 2. Elkay: www.elkay.com.
 3. Kohler Company: www.kohler.com.
 4. Zurn Industries, Inc: www.zurn.com.
 5. Sloan
- B. Supply Faucet Manufacturers:
1. American Standard Inc: www.americanstandard.com.
 2. Chicago: www.chicagofaucets.com.
 3. Delta Faucets: www.specselectonline.com.
 4. Kohler Company: www.kohlerco.com.
 5. T&S Brass
 6. Zurn
 7. Vitra: www.vitra-usa.com.

8. Symmons
- C. Lavatory (L-1):
 1. Model: American Standard 9482.000.
 2. Description: ADA compliant, vitreous china, rear overflow, and faucet holes on 4 inch centers.
 3. Mounting: Under-counter.
 4. Lavatory faucet: One Handle
 - a. Model: Delta 501-HGMHDF
 - b. Description: 4 inch centerset lavatory faucet with solid brass body. 4 1/2" long spout, 0.5 GPM vandal resistant aerator & single lever handle.
 - c. Provide with Lawler 570, Powers LFLM495, Watts LFMMV, or equivalent thermostatic mixing valve with spindle to adjust temperature and internal check valves. Rated for 0.5 GPM use.
- D. Accessories:
 1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon. Provide with Truebro lav guards for waste and supplies or equal.
 2. Waste with perforated open strainer.
 3. Provide lavatories with thermostatic mixing valve.
 - a. Manufacturer and Model:
 - 1) Lawler 570.
 - 2) Powers LFLM495.
 - 3) Watts LFMMV.
 - 4) Equivalent thermostatic mixing valve with ASSE 1070 rating.
 4. Stop Valves
 - a. Brasscraft model KT series stop valves shall be used for all stops.

2.04 SINKS

- A. Sink Manufacturers:
 1. American Standard, Inc: www.americanstandard-us.com.
 2. Elkay: www.elkay.com.
 3. Just: www.justmfg.com.
 4. Kohler Company: www.kohler.com.
 5. Franke
 6. Kindred
- B. Supply Faucet Manufacturers:
 1. American Standard Inc: www.americanstandard.com.
 2. Chicago: www.chicagofaucets.com.
 3. Delta Faucets: www.deltafaucet.com.
 4. Kohler Company: www.kohlerco.com.
 5. T & S Brass
 6. Symmons
- C. Sink (S-1):
 1. Model: Just DLADA2128A55-J
 2. Description: Type 304, 18 gauge stainless steel, dual compartment sink with 3 faucet holes on 4 inch centers.
 - a. Provide with rear drain location when installed in a ADA location
 - b. Refer to architects plans for ADA requirements.
 3. Mounting: In-counter.
 4. Faucet: 2 Handle
 - a. Model: Chicago 786-GN8AE3CP.
 - b. Description: ADA compliant, brass construction, 8" long swiveling gooseneck faucet with 2.2 GPM aerator chrome finish. Provide with 4" wrist blade handles.

5. Accessories:
 - a. Chrome plated 17 gage (1.3 mm) brass P-trap with clean-out plug and arm with escutcheon. Provide with Truebro sink guards or equal.
 - b. Grid strainer.
 - c. Basket strainer
 - d. Brasscraft model KT series stop valves.

2.05 SERVICE SINKS

- A. Service Sink Manufacturers:
 1. Commercial Enameling Company: www.cecosinks.com.
 2. Elkay Manufacturing Company: www.elkay.com.
 3. Fiat
 4. Just Manufacturing Company: www.justmfg.com.
 5. Zurn Industries, Inc: www.zurn.com.
 6. Mustee: www.mustee.com.
 7. Proflo
- B. Faucet Manufacturers:
 1. Chicago Faucet
 2. T&S Brass
 3. Symmons
- C. Laundry Tub (LT-1):
 1. Model: Mustee 17W.
 2. Description: 1 piece, white, wall mounted with mounting bracket and side supports, molded blend of fiberglass and crushed stone (Durastone) construction laundry tub with integral center drain.
 3. Faucet:
 - a. Model: Chicago 891.
 - b. Description: Chrome plated, brass construction service faucet with 6" long vacuum breaker spout and 3/4" hose threads.
- D. Refer to architects elevations for mounting heights unit.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with 1/4 turn ball valve stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts. Caulk around perimeter of fixtures.
- E. Seal under the rim of self-rimming counter top mounted sinks and lavatories with either caulk or putty.
- F. Refer to architects plans and elevations for mounting heights, locations, and accessibility for all bathtub/shower and shower heads, controls, and accessories. All component locations must

meet architectural, plumbing, and ADA code requirements. Any discrepancies or questions shall be brought to the attention of the architect and engineer prior to installation of fixture.

- G. Refer to architects plans and elevations for mounting locations and heights of all fixtures and accessories. Any discrepancies or questions shall be brought to the attention of the architect and engineer prior to installation of fixture.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Repair or replace damaged products before Date of Substantial Completion.
- C. Do not permit use of fixtures during construction.

END OF SECTION

**SECTION 230100
HVAC GENERAL REQUIREMENTS**

PART 1 - GENERAL

1.01 APPLICABILITY

- A. The work covered by the Division of the Specifications consists of providing all labor, supervision, equipment, materials, all incidentals, related items and appurtenances, and performing all operations necessary to complete the installation of work in strict accordance with these specifications and drawings.
- B. All work shall be finished, tested, and ready for operation. The word "Provide" shall mean "furnish and install complete and ready for use".

1.02 DRAWINGS:

- A. The drawings indicate the extent and general layout of the mechanical systems intended for the building. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, connections, and accessories which may be required. Provide offsets, fittings, valves, and accessories as may be required, to produce a complete and operating installation of type shown and specified.
- B. Mechanical drawings are diagrammatic in nature and should not be scaled to obtain dimensions. Obtain dimensions and locations of partitions, walls, etc., from the Architectural dimensioned drawings. Consult the Architectural drawings for details of construction, location of suspended ceilings, ceiling heights, and other pertinent information. Architect's drawings shall not take precedence over field measurements.
- C. All drawings and specifications shall be considered in bidding. The drawings and specifications are complimentary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict arise between drawings and specifications, such conflict shall be brought to the attention of the Architect.

1.03 SUBMITTALS

- A. All submittals to be reviewed, approved, and stamped by submitting contractor prior to submittal to engineer. Submittals not reviewed by submitting contractor prior to submittal to engineer will be returned marked "Not Reviewed".

1.04 APPROVED MANUFACTURERS

- A. Requests for substitution of materials and/or equipment other than those named in the specifications may be made to the Engineer. The request shall be made in duplicate and shall include a request for approval or substitution, pre-addressed, postage pre-paid envelope and information relating to the suitability of the product. No requests by fax. Requests shall be in the Engineer's office not later than ten (10) days prior to Bid Date. Addenda will publish the approved requests.
- B. Where approved manufacturers are indicated in the specifications, the approval does not relieve the responsibility of the contractor to provide products and systems which meet the requirements of the specifications and drawings.
- C. Performance, dimensions, electrical requirements, and functions shall be coordinated with the basis of design indicated on the drawings and in the specifications. If there are differences from the basis of design they should be brought to the attention of the Engineer.
- D. Revisions required by the differences from basis of design, shall be provided to the Owner without additional cost. Revisions to the work of other contractors on the project, due to differences in equipment, shall be provided by the contractor supplying the equipment at no additional cost to the Owner.

1.05 INSTRUCTION OF OWNER'S EMPLOYEES:

- A. Provide, without additional expense to the Owner, the services of competent instructors, who will give full instructions in the care, adjustment, and operation of all parts of the mechanical

equipment to the Owner's employees who are to have charge of the equipment.

- B. An operating and maintenance manual shall be made available to the Owner's operating personnel during the instruction and left with the Owner upon completion of the instruction.
- C. The instruction provided for each system shall be as specified in other sections of this specification. Have the Owner's employees sign a statement that they were present for the training session. Submit a copy of the sign-in sheet with close-out documents.

1.06 INSTALLATION OF EQUIPMENT:

- A. All appliances and equipment shall be installed and connected in accordance with manufacturer's instructions and recommendations unless such instructions are in conflict with these specifications.
- B. All equipment shall be installed in such a manner and location as to facilitate accessibility for maintenance and/or replacement.
- C. As a part of the work of this contract, the Mechanical Contractor shall make any changes in the pulleys, belts, and dampers, and shall install additional dampers required for correct balance as recommended by air balance agency, at no additional cost to the Owner.
- D. The use of permanent HVAC system for temporary heating, cooling, ventilating and air conditioning is prohibited.

1.07 COOPERATION WITH OTHER TRADES:

- A. Cooperate with other trades so as to avoid interferences. Where required to avoid interferences with other work or to increase the headroom, the Contractor shall off-set the piping and/or re-route the duct work where directed by the Engineer. Carefully check all construction details to assure the proper installation of all work under this specification. Schedule the work such that it will keep pace with the work of other crafts and cause no delay.

1.08 INSPECTION OF SITE:

- A. Before submitting a proposal on the work contemplated in these specifications and accompanying drawings, each bidder shall examine the site and familiarize himself with all of the existing conditions and limitations. No extras will be allowed because of Contractor's misunderstanding as to the amount of work involved or lack of his knowledge of any condition in connection with the new construction.

1.09 CODES, ORDINANCES, REGULATIONS, & STANDARDS:

- A. The entire installation shall be made in accordance with all state and local laws. If, in any instance, the plans and specifications conflict with such laws, the law shall take precedence. This, however, shall not be construed as relieving the contractor from complying with any requirements of the drawings and specifications that may be in excess of the rules and not contrary to the same.
- B. All work shall conform to applicable state and local codes, ordinances, regulations, and/or standards.

1.10 PERMITS, LICENSES AND FEES

- A. The contractor shall secure and pay for all the associated permits, fees, licenses and inspections by government agencies necessary for proper execution and completion of the work that are customarily secured after execution of the contract and legally required at the time bids are received or negotiations concluded.

1.11 CONTRACTOR WARRANTIES

- A. Contractor shall guarantee all equipment, materials, and workmanship for a period of one year from the date of final completion. Any defects in equipment, materials or workmanship that appear or cause any issues within the one year period shall be repaired at no additional cost, (this shall include materials and labor). Refer to all other specification sections for additional guarantees/warranties requirements.

1.12 TRENCHING, BACKFILL AND COMPACTION

- A. Provide trenching, backfill and compaction for buried mechanical systems. Refer to Divisions 1 and 31 specifications for requirements.
- B. As a minimum requirement, the fill shall be either subsoil excavated on-site or engineered fill. The fill shall be free of lumps larger than 3 inches, rocks larger than 2 inches, frozen or spongy and wet material not capable of compaction in place.

PART 2 - PRODUCTS

2.01 OPERATION & MAINTENANCE MANUALS

- A. Contractor to provide Operation and Maintenance manuals to meet all requirements detailed by this section in addition to all requirements defined in Section 01 of this manual.
- B. The contractor shall furnish two (2) hard copy Operation and Maintenance Manuals for the mechanical systems.
- C. Manuals shall be bound in new 3 ring binders, 2" D-ring, black color, with the title "Operations and Maintenance Manual" and the project title and volume number clearly printed on the front cover and spine of the binders.
- D. Manual shall include an index in the front of each manual for the sections included in the manual. Each section shall be referenced with plastic tabs.
- E. Include in the front of each manual a complete listing of all mechanical contractors and sub-contractors used on the project. Include names, addresses and phone numbers for each contracted listed.
- F. Manuals shall be arranged by specification number. Each piece of equipment shall be referenced by tag number with tabs. At the beginning of each section, the equipment supplier's name, address and phone number shall be provided.
- G. Data for equipment included in the manuals:
 - 1. Approved shop drawings clearly showing the models, sizes and capacities of equipment used. All shop drawings included in the manual shall have all review comments addressed.
 - 2. Operations Manuals detailing step by step procedures for putting equipment into operation.
 - 3. Maintenance Manuals from the manufacturer of each piece of equipment including instructions for installation, maintenance and lubrication. Manuals shall include parts lists for all replacement parts.
 - 4. All equipment warranty information with warranty registration completed in owners name.
- H. Include the following reports in the manuals:
 - 1. Testing and balancing reports for air and water systems as specified.
 - 2. Start-up reports.
 - 3. Valve and damper tag lists.
- I. Submit one hard copy of the Operation & Maintenance Manuals to the Engineer and the Contracting Officer for approval prior to delivery to the Owner.

2.02 SUB-BASES FOR EQUIPMENT:

- A. Sub-bases shall be provided for all equipment such as fans, water heaters, boilers, pumps, air compressors, and refrigeration machines. Each electric motor shall be mounted on the same sub-base as the driven machine.
- B. Sub-bases generally consist of pads constructed of 2500 psi concrete with all exposed surfaces finished with cement mortar, troweled smooth. Machines other than those supported on isolation units shall be secured to concrete sub-bases with anchor bolts of ample size. All machines having bed plates and flexible and solidly connected motors shall be grouted under the full area of the bed plates with a non-shrinking, premixed grout. After grout has set, all wedges, shims, and jack bolts shall be removed and spaces filled with grout.

- C. Premanufactured rooftop curbs and/or supports for any roof mounted item supplied under this division of the specifications shall be provided by the Mechanical Contractor. Sizes, locations, and installation shall be coordinated with the Roofing Contractor. Where the roof is pitched, the curb shall be designed for the pitch of the roof. Curbs shall be insulated.

2.03 MECHANICAL ANCHORS TO CONCRETE

- A. Anchors shall have current ICC-ES report that demonstrates compliance with ACI 355.2 supplemented by ICC-ES AC 193.

2.04 SUPPORTING STEEL, ROOF AND WALL OPENINGS:

- A. Provide structural steel framework for supporting mechanical equipment as required.
- B. Unless otherwise indicated by the drawings, lintels for new mechanical openings shall be provided by the contractor installing the pipe or duct.
- C. Unless otherwise indicated by the drawings, angles to frame a new roof opening through the roof deck shall be provided by the contractor installing the pipe or duct through the roof.
- D. All steel work shall be in conformance with the requirement of the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings. Material shall conform to ASTM A36.

2.05 SLEAVES, CUTTING, AND CORE DRILLING:

- A. Provide sleeves for piping and ductwork openings in masonry walls.
- B. The contractor shall saw cut or core drill existing masonry floors and walls for new ductwork and/or piping penetrations. The contractor shall cut new openings through framed walls for ductwork and/or piping penetrations. Provide headers as needed in frame walls.

2.06 FIRESTOPPING

- A. Provide firestopping assemblies for the required fire ratings and listed in the current year certification books of UL, FM or ITS (Warnock Hersey).
- B. See the Architectural drawings for required ratings. Refer to the Mechanical drawings for additional ratings. Provide firestopping for all penetrations of these assemblies.

2.07 SEALING PENETRATIONS IN NON-RATED WALLS AND FLOORS

- A. Provide caulk at penetrations of non-rated walls and floors for ductwork and piping. If the gap is too large for caulk, provide fiberglass insulation for backing. Conceal the fiberglass with either caulk or sheetmetal. Refer to specifications for sleeve requirements.
- B. In mechanical rooms and other water-proof floor areas, provide sleeves or concrete pads at least 2" higher than the top of slab to prevent water from running through the annular space between the duct or pipe and the floor opening. In addition to the sleeve, provide packing and caulking around the duct or pipe inside the sleeve to prevent noise transmission through openings in the floor.

2.08 ACCESS DOORS IN CEILINGS AND WALLS

- A. Provide metal lockable access doors in gypsum board ceilings and walls where needed for access to dampers or valves. Coordinate the installation of the access doors with the ceiling contractor. Confirm the location of the panels with the Architect. Provide rated doors where required, refer to architects plans for rated walls/ceilings.

PART 3 - EXECUTION

3.01 FIRESTOPPING INSTALLATION

- A. Verify openings are ready to receive the firestopping. Modify the openings as required to accommodate the requirements for the certified assembly drawing for the firestopping material.
- B. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- C. Remove incompatible materials that could adversely affect bond.

3.02 TRENCHING, BACKFILL AND COMPACTION

- A. Refer to Divisions 1 and 31 specifications for requirements.
- B. Compact to minimum of 95 percent of maximum dry density. Cut out soft areas and backfill. Do not fill with frozen materials. Place and compact in layers not exceeding 8 inches compacted depth. Correct areas that are over-excavated. Maintain moisture content of fill materials to obtain compaction density.

END OF SECTION

**SECTION 230519
METERS AND GAUGES FOR HVAC PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Static pressure gauges.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- B. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
- B. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

- A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Case: Steel with brass bourdon tube.
 - 2. Size: 4-1/2 inch diameter.
 - 3. Mid-Scale Accuracy: One percent.
 - 4. Scale: Psi.

2.02 PRESSURE GAUGE TAPPINGS

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

2.03 SOLAR POWERED DIGITAL THERMOMETERS

- A. Omega SPT10 or equivalent.
- B. Case: Hi-impact ABS
- C. Range: -40 to 150°C (-40 to 300°F)
- D. Display: 9.5 mm (3/8") High LCD digits
- E. Case: Hi-impact ABS
- F. Range: -40 to 150°C (-40 to 300°F)
- G. Display: 9.5 mm (3/8") High LCD digits
- H. Accuracy: 1% of reading or 1°, whichever is greater
- I. Autorange Resolution:
 - 1. 1°: -40 to 27°C (-40 to 19°F)
 - 2. 0.1°: -28.0 to 93.0°C (-19.9 to 199.9°F)
 - 3. 1°: 94 to 150°C (200 to 300°F)
- J. Recalibration: Internal potentiometer
- K. Lux Rating: 10 Lux (1' candle)
- L. Display Update: 10 seconds
- M. Ambient Operating: -30 to 140°F
- N. Ambient Temp Error: Zero

- O. Humidity: 95% RH non-condensing
- P. Sensor: Glass passivated thermistor
- Q. Stem interchangeable with industrial glass thermometers.

2.04 TEST PLUGS

- A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

2.05 STATIC PRESSURE GAUGES

- A. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.
- C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- D. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 230943. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.
- E. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- H. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION

**SECTION 230553
HVAC IDENTIFICATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Adhesive Film Labels.
- C. Tags.

1.02 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.03 SUBMITTALS

- A. Chart and Schedule: Submit a valve chart and schedule, including valve tag number, location and function.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Identification of Equipment Outside the Building:
 - 1. **All equipment provided by Division 23 outside the building shall be identified with laminated engraved plastic nameplates. Printed labels will not be accepted. Equipment outside the building may be on the roof, mounted on the exterior wall, set on grade, or other locations exposed to weather. Common equipment outside the building may include, but is not limited to, the following: exhaust fans, packaged rooftop units, make-up air units, condensing units, air cooled chillers, cooling towers, drycoolers, dust collectors, and pumps.**
- B. Identification Inside the Building:
 - 1. Air Handling Units, Energy Recovery Units, Heat Pumps, Furnaces, Fan Coil Units, Exhaust Fans and similar fan systems: Adhesive film labels..
 - 2. Control Panels: Adhesive film labels.
 - 3. Dampers: Tags or adhesive film labels on the actuator.
 - 4. Boilers: Adhesive film labels.
 - 5. Piping: Pipe markers.
 - 6. Pumps: Adhesive film labels..
 - 7. Small-sized Equipment: Tags.
 - 8. Thermostats: Adhesive film labels behind the cover.
 - 9. Valves: Tags . Key to the plans and the valve schedule.
 - 10. Balancing Valves: Tags indicating design gpm and pressure drop. Key to the equipment served.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/2 inch.
 - 3. Background Color: Black.

2.03 ADHESIVE FILM LABELS

- A. Description: Machine printed, black letters, by thermal transfer or equivalent process on a white background. Minimum letter height shall be 1/2 inch. The laminated label shall provide a durable surface resistant to water, glycol, heat and cold.

2.04 TAGS

- A. Metal Tags: Aluminum or brass with stamped letters or with an adhesive film label; tag size minimum 1-1/2 inch diameter with smooth edges.

- B. Chart: Typewritten letter size list in anodized aluminum frame. Either a floor plan of the building indicating location of valve or describe location by room number, etc. Also include description of service and duty of valve, unless obvious from location on the floor plan.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 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 identification labels at locations for the most convenient viewing without interference with operation and maintenance of equipment.
- C. Install tags with corrosion resistant chain.
- D. Tag automatic controls, instruments, and relays. Key to control schematic.
- E. Identify piping concealed above accessible ceilings with plastic pipe markers. Piping in equipment rooms, garages, tunnels and similar un-finished type spaces shall be identified with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with the axis of piping. Location of identification not to exceed 20 feet 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

**SECTION 230593
TESTING, ADJUSTING, AND BALANCING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic and plumbing recirculating hot water systems.

1.02 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. AABC MN-1 - AABC National Standards for Total System Balance; 2002.
- C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).
- D. SMACNA - HVAC Air Duct Leakage Test Manual, current edition.

1.03 SUBMITTALS

- A. Duct Leakage Testing Reporting: Provide written report when test is successful for each section of tested.
- B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. 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.
 - 2. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 3. Form of Test Reports: Reports in accordance with one of the referenced standards.
 - 4. Units of Measure: Report data in I-P (inch-pound) units only.

PART 2 EXECUTION

2.01 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. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
 - 3. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute.
 - 4. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

2.02 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. Hydronic systems are flushed, filled, and vented.
 13. Pumps are rotating correctly.
 14. Proper strainer baskets are clean and in place.
 15. Service and balance valves are open.
 16. Suitable access to balancing valves and equipment is provided.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

2.03 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 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 10 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.
- D. Plumbing Recirculating Hot Water Systems: Adjust to within plus or minus 10 percent of design.

2.04 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

2.05 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct. A pitot tube traverse shall be required at each supply, return, exhaust, outside air, and relief air fan unless otherwise noted.
- 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. 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.
- H. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- I. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- J. Test air handling system in economizer mode. Verify proper operation and adjust, if necessary.

2.06 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 gages 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. Effect system balance with automatic control valves fully open to heat transfer elements.
- D. 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.
- E. 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.
- F. For variable volume hydronic systems, report the minimum required pipe pressure at the pressure transducer location(s) in order to provide design supply water flows. Transmit in writing the required minimum pressure to the temperature controls subcontractor for programming the variable speed drive.

2.07 SCOPE

- A. Test, adjust, and balance all mechanical and plumbing equipment indicated on the drawings and specifications. Submit reports on NEBB or AABC forms.

END OF SECTION

SECTION 230713 DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Insulation jackets.

1.02 REFERENCE STANDARDS

- A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- C. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum ten years of experience and approved by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.05 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. 'K' value: maximum 0.31 at 75 degrees F, when tested in accordance with ASTM C 518. Lower 'K' values may be required in some cases to meet the required R-value in the schedule.
 - 2. Maximum Water Vapor Absorption: 5.0 percent by weight.
- B. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 3. Secure with pressure sensitive tape.
- C. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 JACKETS

- A. Laminate Jacket:
1. Product: Venture Clad 1577CW or equal.
 2. Description: 5-ply, self adhesive laminate jacket with puncture and tear resistance, zero permeability, and vapor barrier.
 3. Finish: Aluminum embossed.
 4. Temperature Range: -30 to 300 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Duct Application:
 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.

3.03 SCHEDULES

- A. R-values listed in the schedule are minimum values. The requirement is for installed R-value assuming 25% compression of the insulation. PCF is an abbreviation for pounds per cubic foot.
- B. Combustion Air Duct:
 1. Flexible Glass Fiber: 2 inches thick, 1.50 pcf
- C. Exhaust Ducts Within 10 ft of Exterior Openings:
 1. Flexible Glass Fiber: 2 inches thick, 1.50 pcf
- D. Supply Ducts in concealed spaces:
 1. Rigid Glass Fiber: 2 inches thick, 3 pcf (R-8)
- E. Insulated Flexible Ducts: R-5

END OF SECTION

**SECTION 230716
HVAC EQUIPMENT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Equipment insulation.

1.02 REFERENCE STANDARDS

- A. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.
- B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.

- B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Factory Insulated Equipment: Do not insulate.
- C. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
- F. Insulated equipment containing fluids below ambient temperature; insulate entire system.
- G. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.
- H. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- I. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- J. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
- K. Inserts and Shields:
 - 1. Application: Equipment 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between hangers and inserts.
 - 3. Insert Location: Between support shield and equipment and under the finish jacket.
 - 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoin
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- L. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

3.03 SCHEDULE

- A. Heating Systems:
 - 1. Air Separators: 1" Flexible Elastomeric
 - 2. Expansion Tanks: 1" Flexible Elastomeric

END OF SECTION

**SECTION 230719
HVAC PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.

1.02 REFERENCE STANDARDS

- A. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- B. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017.
- C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2019.
- E. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2017, with Editorial Revision (2018).
- F. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.
- G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2018).
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of experience.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.05 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

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.02 GLASS FIBER

- A. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. Maximum Service Temperature: 650 degrees F.
 - 2. Maximum Moisture Absorption: 0.2 percent by volume.
- B. 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.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. 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.
 - 2. Maximum Service Temperature: 180 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.
- B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- G. 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.
- H. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches 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 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.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.03 SCHEDULE

- A. Heating Systems:
 - 1. Heating Supply and Return (Glycol and Non-Glycol):
 - a. Glass Fiber
 - 1) 1-1/4" and less: 1 1/2 inch
 - 2) 1-1/2" and larger: 2 inch
- B. Cooling Systems:
 - 1. Refrigerant Suction:

- a. Flexible Elastomeric
 - 1) 1" and less: 1/2 inch
 - 2) 1 1/4" and larger: 1 inch
- 2. Refrigerant Hot Gas:
 - a. Flexible Elastomeric
 - 1) 1" and less: 1/2 inch
 - 2) 1 1/4" and larger: 1 inch

END OF SECTION

**SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Control panels.
- B. Damper Operators:
- C. Input/Output Sensors:
 - 1. Temperature sensors.
- D. Thermostats:
 - 1. Electric room thermostats.
- E. Time clocks.
- F. Emergency Shutdown Switches
- G. Nitrogen Dioxide and Carbon Monoxide Detector

1.02 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.
- C. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; 2013.

1.03 SUBMITTALS

- A. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- B. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience approved by manufacturer.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- B. NEMA 250, general purpose utility enclosures with enameled finished face panel.
- C. Provide common keying for all panels.

2.03 NITROGEN DIOXIDE AND CARBON MONOXIDE DETECTOR

- A. Manufacturers:
 - 1. Brasch

2. Honeywell
 3. Opera Detectors
 4. Tox-Alert
 5. AGS
- B. The detector shall be an ETL listed unit containing a control board and sensor board that conforms completely to the UL 3111-1 standard.
 - C. The NEMA 1 enclosure shall be constructed of heavy polycarbonate plastic, which consists of two pieces, cover and chassis. The cover shall close flush with the sides of the box and shall require a special tool to open it. The sensor module shall be protected from damage inside the enclosure and the cover shall contain screened openings to allow proper sensing. The openings shall conform to the UL 3111-1 standard.
 - D. The detector shall contain an electro-chemical carbon monoxide (CO) sensor with temperature compensation circuits and an electro-chemical nitrogen dioxide (NO₂) sensor. The enclosure shall be provided with four, ½" pre-punched openings for connection of field conduit. The detector shall include factory-installed wiring that exits the enclosure and allows for installation without the detector being opened.
 - E. The detector shall be protected against static discharge, excessive electrical noise, and tested for safety in accordance with the UL 3111-1 standard.
 - F. The detector shall have a 0.5" minimum height, liquid crystal display (LCD) that will continually display the current nitrogen dioxide (NO₂) and carbon monoxide (CO) level, in parts per million. The detector shall have a green "power" LED, a yellow "sensor-active" LED, a red "low-alert" LED, a red "high-alert" LED and a red "alarm" LED.
 - G. The detector shall contain a power supply fuse rated for 0.400 amp at 250 VAC, (if 24 VAC powered), or 0.125 amp at 250 VAC, (if 120 VAC powered). Each output relay shall have a fuse rated for 5 amp at 250 VAC. Fuses shall be of the time-lag type.
 - H. Provide override switch to operate the make-up air unit and exhaust fan from detector.
 - I. An external push button on the front of the enclosure shall be provided to silence the 106 dB internal alarm. The alarm circuit shall become active again, once the detector is no longer at alarm levels.
 - J. Output relays providing a normally closed set of contacts for the low-alert and for the alarm shall be provided. These relays shall provide a fail-safe that will automatically activate ventilation equipment upon power loss to the sensor. The low-alert and high-alert relays shall be capable of being configured in the field for a two speed fan or for 50%/100% fan control operations. These relays shall be suitable for the connection of 24 VAC, 24 VA inductive circuits.
 - K. Switches shall be provided for field adjustment of the gas detection level for the low-alert, and of the on/off time delay for the low-alert and high-alert. Selectable CO detection levels shall range from 20 to 55 ppm and the NO₂ detection levels shall range from 0.3 to 4.0 ppm. Selectable time delays shall range from 0 to 7 minutes, in 1 minute increments.
 - L. Provide multiple sensors in the garage for the floor area and in accordance with the rating of the sensor.
 - M. Provide all wiring in conduit from the sensors to the controller. Provide power to the controller from a spare circuit. Provide all relays, wiring and conduit to control the dampers and exhaust fans from the controller.

2.04 OUTSIDE AIR AND RELIEF AIR CONTROL DAMPERS

- A. Approved Manufacturers:
 1. Greenheck
 2. Ruskin
 3. Tamco
 4. Nailor

- B. Dampers larger than 10"x10" or 10"Ø shall meet the following requirements:
1. Basis of design: Greenheck ICD-45.
 2. Construction:
 - a. Rectangular dampers shall consist of: .125 (3.2mm) aluminum channel frame insulated with polystyrene on four sides and thermally broken with dual polyurethane resin gaps; aluminum airfoil blade internally insulated polyurethane foam and thermally broken. Blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance to airflow in either direction or pressure on either side of the damper. Axle will be 1/2 in. (13mm) diameter plated steel; bearings are dual bearing with acetal inner sleeve, flanged outer bearing resulting in no metal-to-metal or metal-to-plastic contact.
 - b. Blade and jamb seals to be silicone rubber and external (out of the airstream) blade-to-blade linkage.
 3. Ratings:
 - a. Dampers manufacturer's printed application and performance data including pressure, velocity, leakage, and temperature limitations shall be submitted for approval showing damper suitable for pressures to 8 in. wg (1993 Pa), velocities to 4000 fpm (20.3 m/s), standard air leakage less than 8 cfm/sq. ft. @ 4 in. wg and temperatures to 200 °F
 - b. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.

2.05 DAMPER OPERATORS

- A. Direct Coupled Electronic Operators:
1. Spring return control damper actuators shall be direct coupled type which require no crankarm and linkage and be capable of direct mounting. The actuator must provide proportional damper control in response to a 2 to 10 VDC or a 4 to 20 mA control input from an electronic controller or positioner.
 2. The actuators must be designed so that they may be used for either clockwise or counterclockwise fail-safe operation.
 3. Actuators shall have control direction of rotation switch accessible on its cover. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation. Run time shall be constant, and independent of torque. A 2 to 10 VDC feedback signal shall be provided for position feedback or master-slave applications.
 4. Actuators shall be UL listed and CSA certified, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards.
 5. Verify damper operator requirements, including but not limited to voltage, with controls contractor prior to purchase of dampers.

2.06 INPUT/OUTPUT SENSORS

- A. Temperature Sensors:
1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.

2.07 THERMOSTATS

- A. Electric Room Thermostats:
1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
 2. Service: Cooling and heating.
 3. Covers: Provide clear locking covers on thermostat in public areas.
 4. 7-day programmable thermostat, with the correct number of stages of heating and cooling for the equipment it serves. Honeywell VisionPro TH8000 series or approved equal.

2.08 TIME CLOCKS

- A. Seven day programming switch timer with synchronous timing motor and seven day dial, continuously charged Ni-cad battery driven power failure 8 hour carry over and multiple switch trippers to control systems for minimum of two and maximum of eight signals per day with two normally open and two normally closed output switches.

2.09 EMERGENCY SHUTDOWN SWITCHES

- A. ADA compliant emergency power off push button switch station. Provide with red push switch. Rated for indoor/outdoor use as required. Designed for single gang box installation.
 - 1. Provide switch/switches for boilers at boiler rooms doors. Coordinate exact switch locations and quantity with local boiler inspector.
 - 2. Provide at any other locations called out on plans.
- B. Label for use and provide with clear (lift to open) cover.
- C. Provide all associated wiring and controls as required for a complete system.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.
- G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor.
- C. Provide mixing dampers of opposed blade construction arranged to mix streams.
- D. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.
- E. Provide all power, transformers, relays, control wiring, conduit and all other electrical components as required to control the mechanical equipment. Provide all wiring in conduit.

END OF SECTION

SECTION 232113 HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Heating water and glycol piping, above grade.
- C. Radiant Heating Tubing
- D. Pipe hangers and supports.
- E. Unions, flanges, mechanical couplings, and dielectric connections.
- F. Valves:
 - 1. Ball valves.
- G. Manual Balancing Valves.

1.02 REFERENCE STANDARDS

- A. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications; 2019.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- E. ASME B31.9 - Building Services Piping; 2017.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- H. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- J. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.
- K. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).
- L. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

1.03 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Use unions and flanges downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- C. Use ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Use ball valves for throttling, bypass, or manual flow control services.
- E. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

1.04 SUBMITTALS

- A. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

- B. Product Data:
 - 1. Indicate balancing valve data and ratings.
- C. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum ten years of experience.
- C. All welding of pipe shall be performed by AWS certified welders.

1.06 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.
- B. All welding of pipe shall be performed by AWS certified welders.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

1.09 EXTRA MATERIALS

- A. Provide two repacking kits for each size and valve type.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Valves: Provide valves where indicated:

2.02 RADIANT HEATING AND TUBING, BURIED

- A. Manufactures:
 - 1. Comfort Pro: www.comfortprosystems.com
 - 2. Mr. Pex: www.mrpexsystems.com
 - 3. Watts Radiant: www.wattsradiant.com
 - 4. Wirsbro
 - 5. Raupex
 - 6. Heat Link
 - 7. Rehau
- B. Radiant tubing shall be single layer, cross linked polyethylene in accordance with ASTM F-876/877 standards and conform to SDR-9 dimensions. See drawings for tubing lengths and size.
- C. Radiant tubing shall have a minimum bend radius of 8 times the outside diameter.
- D. Radiant tubing shall have an EVOH oxygen barrier manufactured to ASTM F-876/877 standards.
- E. Factory supplied supply and return manifolds shall be 1-1/4 inch cast brass or stainless steel. Supply manifold shall have built in flow meters and thermometer. Return manifolds shall have built-in balancing valves and thermometer. Provide factory supplied, painted, galvanized steel

construction, enclosure for the manifolds and radiant mixing blocks.

- F. Tubing shall have ratings of 200 °F at 80 psig, 180 °F at 100 psig, and 73.4 °F at 160 psig operating temperature and operating pressures respectively.

2.03 RADIANT HEATING INSULATION

- A. Refer to the drawings for locations of radiant tubing. Provide 2" thick extruded polystyrene, Owens Corning Foamular 250 or equivalent. The R-value shall be at least R-10. The compressive strength shall be minimum 25 psi at 10% deflection.

2.04 HEATING WATER AND GLYCOL PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
 - 1. Fittings: ASTM B 16.3, malleable iron or ASTM A 234/A 234M, wrought steel welding type fittings.
 - 2. Joints: Threaded, or AWS D1.1 welded.
 - 3. Pressed Joints and Fittings: Viega MegaPress.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
 - 1. Solder Joints for 2 inch and smaller/Brazed Joints for 2-1/2 inch and larger: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (91-5 tin-antimony) or tin and silver.
 - 2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
 - 3. Mechanical Press Sealed Fittings: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of ASME B16.51 and IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer.
 - 4. Joints: Solder, lead free, 95-5 tin-antimony, or tin and silver.

2.05 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.
- B. Provide oversized hangers on insulated pipe to allow insulation at full thickness to be provided on the piping.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
- D. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
- E. Hangers for Hot Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
- F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- G. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- H. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.
- I. Vertical Support: Steel riser clamp.
- J. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- K. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe 2 Inches and Less:
 - 1. Ferrous Piping: 150 psig malleable iron, threaded.
 - 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe 2 Inches and Greater:
 - 1. Ferrous Piping: 150 psig forged steel, slip-on.

2. Copper Piping: Bronze.
 3. Gaskets: 1/16 inch thick preformed neoprene.
- 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. Gasket Material: EPDM suitable for operating temperature range from -30 degrees F to 250 degrees F complying with ASTM D-2000.
 4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 5. When pipe is field grooved, provide coupling manufacturer's grooving tools.
 6. Manufacturers:
 - a. Grinnell Products, a Tyco Business: www.grinnell.com.
 - b. Victaulic Company: www.victaulic.com.
 - c. Gruvlock, Anvil

2.07 BALL VALVES

- A. Manufacturers:
1. Apollo Valves: www.apollovalves.com
 2. Nibco
 3. Jomar.
 4. Milwaukee.
 5. Viega LLC: www.viega.us/#sle.
 6. Stockham
- B. Up To and Including 2 Inches:
1. Bronze one piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, lever handle, solder ends with union.

2.08 MANUAL BALANCING VALVE

- A. Manufacturers:
1. Griswold Controls: www.griswoldcontrols.com.
 2. Tour & Andersson
 3. Armstrong
 4. ITT Bell & Gossett: www.bellgossett.com.
 5. Pro Hydronics Specialties
 6. Gerand.
 7. Taco, Inc: www.taco-hvac.com.
 8. Nexus
 9. Hydronic Components Inc
 10. Stockham
- B. Manual Balancing Valves:
1. Construction Option 1: Class 125, brass body housing including a full port isolation ball valve with memory stop, venturi measurement device, dual pressure/temperature test valves, and unions on inlet and outlet.
 2. Construction Option 2: Class 125, brass body housing including a y-pattern globe style calibrated port balancing valve design, dual pressure/temperature test valves, and unions on inlet and outlet. Provide wheel handle with memory stop for balancing adjustments.

PART 3 EXECUTION

3.01 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 using jointing system specified.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Radiant Heating and Tubing:
 - 1. Tubing shall not be exposed to sunlight for more than 14 days.
 - 2. Provide pressure testing of between 50 and 100 psi for a minimum of 24 hours prior to, and during the pour of concrete applications and while other trades are working in the same area.
 - 3. Slab-on-grade installation shall be fastened to flat mesh provided by the contractor installing the tubing, unless insulation is specified under the tubing. Flat mesh shall be placed on top of vapor barrier or sand so that it will be in the bottom of the concrete slab. If insulation is specified, the tubing shall be attached to the insulation board with staples provided by the tubing manufacturer. Verify with the concrete contractor that there will be sufficient clearance to avoid control joint cuts. Coordinate tubing to go under expansion joints.
- C. Install heating water and glycol piping to ASME B31.9 requirements.
 - 1. Sleeve pipe passing through partitions, walls and floors.
 - 2. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.
 - 3. Slope piping and arrange to drain at low points. Provide 1/2" ball valve and cap at each high point for manual air vent. Provide 1/2" ball valve and cap at each low point for drain.
 - 4. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
 - 5. Install temperature controls devices furnished by the controls contractor. Review requirements with the controls contractor. Provide thermo-wells for temperature sensors.
- D. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
 - 2. Support horizontal piping as required by code and piping manufacturer.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Provide copper plated hangers and supports for copper piping.
- E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- F. Provide handle stand-off extensions on valves to provide a minimum of 3/4" clearance between valve handle and piping insulation.
- G. Provide oversized hangers on insulated pipe to allow insulation at full thickness to be provided on all cold temperature piping and hot temperature piping 2 inch and larger.
- H. Provide access panels where valves and fittings are not exposed. Coordinate with general contractor.
- I. Use eccentric reducers to maintain top of pipe level.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

- K. Install valves with stems upright or horizontal, not inverted.
- L. Test radiant tubing system to a minimum pressure of 80 psig. Leave tubing under pressure through concrete installation and cutting of expansion joints in concrete. System must be under pressure for a minimum of 24 hours. Demonstrate test results to project manager.
- M. All new hydronic heating/cooling system piping shall be pressure tested at 1-1/2 times the maximum system design pressure; but not less than 100 psi (hydrostatically) for 15 minutes (minimum).
- N. For grooved pipe installations, a factory trained representative shall provide on-site training to contractor for use of grooving tools and product installation.
- O. Press connections: copper and copper alloy press connections shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool(s) approved by the manufacturer.

END OF SECTION

**SECTION 232114
HYDRONIC SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion tanks.
- B. Air vents.
- C. Air separators.
- D. Suction diffusers.
- E. Pressure-temperature test plugs.

1.02 REFERENCE STANDARDS

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2019.

1.03 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.

1.04 QUALITY ASSURANCE

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

1.05 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

2.01 EXPANSION TANKS

- A. Manufacturers:
 - 1. Amtrol Inc: www.amtrol.com
 - 2. ITT Bell & Gossett: www.bellgossett.com
 - 3. Taco, Inc: www.taco-hvac.com
 - 4. Elbi
 - 5. Armstrong
- B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible heavy duty butyl rubber diaphragm sealed into tank, and steel support stand.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psi.

2.02 AIR VENTS

- A. Manual Type: Short vertical section of pipe to form air chamber, with 1/2" ball valve, 3/4" hose thread and cap.

2.03 AIR SEPARATORS

- A. Air Separators:
 - 1. Manufacturers:
 - a. Armstrong International, Inc: www.armstronginternational.com
 - b. ITT Bell & Gossett: www.bellgossett.com

- c. Taco, Inc: www.taco-hvac.com
 - d. Spirotherm
 - e. Amtrol
2. Steel, tested and stamped in accordance with ASME (BPV VIII, 1); for 125 psi operating pressure, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.04 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International, Inc; _____: www.armstronginternational.com/#sle.
 - 2. Keckley
 - 3. Titan FCI
- B. Size 2 inch and Under:
 - 1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

2.05 SUCTION DIFFUSERS

- A. Manufacturers:
 - 1. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - 2. Taco: <http://www.taco-hvac.com>.
 - 3. Armstrong
- B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh start up screen, and permanent magnet located in flow stream and removable for cleaning.
- C. Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide manual air vents at system high points and as indicated.
- C. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- D. Provide valved drain and hose connection on strainer blow down connection.
- E. Support pump fittings with floor mounted pipe and flange supports.
- F. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.
- G. 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.
- H. Pipe relief valve outlet to nearest floor drain.

END OF SECTION

**SECTION 232123
HYDRONIC PUMPS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Inline wet rotor pumps.

1.02 REFERENCE STANDARDS

- A. NEMA MG 1 - Motors and Generators; 2018.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- B. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.
- C. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Armstrong Fluid Technology, Inc: www.armstrongfluidtechnology.com/#sle.
- B. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com/#sle.
- C. Taco : www.taco-hvac.com.
- D. Grundfos

2.02 INLINE WET ROTOR PUMP

- A. Type: Wet rotor inline pump with ECM motor with built in electrical overload and dry run protection.
 - 1. Provide with integral controller with multiple pressure and temperature control operating modes.
- B. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
- C. Impeller: Bronze, fully enclosed, keyed to motor shaft extension.
- D. Shaft: Alloy steel with bronze sleeve.
- E. Bearings: Grease-lubricated ball bearings.
- F. Performance and Electrical Characteristics: See plans.
- G. Seal For Cleaning: Provide a standard seal in the pumps. After cleaning has been completed and the system has the correct solution, the final pump seals shall be installed.
- H. Final Seal: After cleaning is done and the correct solution has been used to fill the system, the pump seal shall be changed. Turn the cleaning seals over to the Owner. The final seal shall be a high performance seal made for the following conditions.
 - 1. Temperature Range: -20 to 250 deg F.
 - 2. PH Range: 7.0 to 12.5

3. Maximum Dissolved Solids: 25,000 ppm
4. Maximum Undissolved Solids: 40 ppm
5. Maximum Silica: 20 ppm
6. Maximum Glycol Concentration: 60%

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 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 pump suction fitting on pump suction, and line sized soft seat check valve and line sized shut-off valve on pump discharge.
- D. Provide drains for bases and seals, piped to and discharging into floor drains.
- E. PROVIDE LASER ALIGNMENT AND CERTIFY ALIGNMENT OF BASE MOUNTED PUMPS PRIOR TO START-UP. Include the alignment report in the Operation & Maintenance Manuals.
 1. Angular Alignment Tolerances: +/-0.5 Mils per inch.
 2. Vertical/Horizontal Alignment Tolerances: +/-2 Mils per inch.
- F. Check, align, and certify alignment of base-mounted pumps prior to start-up.
- G. Lubricate pumps before start-up.

END OF SECTION

**SECTION 232300
REFRIGERANT PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Filter-driers.
- G. Expansion valves.
- H. Flexible connections.

1.02 REFERENCE STANDARDS

- A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.
- B. AHRI 750 - Thermostatic Refrigerant Expansion Valves; 2007.
- C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants; 2019, with Errata (2020).
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2016.
- F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2019.
- H. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).
- I. ICC (IMC)-2018 - International Mechanical Code; 2018.
- J. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.03 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- B. Liquid Indicators:
 - 1. Use line size liquid indicators in main liquid line leaving condenser.
- C. Valves:
 - 1. Use service valves on suction and discharge of compressors.
- D. Filter-Driers:
 - 1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
- E. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.04 SUBMITTALS

- A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

- B. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.
- C. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

2.02 PIPING

- A. Copper Tube (ACR): ASTM B 280, H58 hard drawn or O60 soft annealed.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
 - 3. Mechanical Press Sealed Fittings: Double pressed type complying with UL 207 and ICC (IMC)-2018.
- B. Pre-insulated Linesets:
 - 1. Factory insulated linesets. Refer to Piping Insulation specifications for insulation requirements.
 - 2. Repair all cracks and exposed piping after installation.
- C. Pipe Supports and Anchors:
 - 1. Provide oversized hangers on insulated pipe to allow insulation at full thickness to be provided on the piping.
 - 2. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 3. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.03 ACCESSORIES

- A. Contractor is to provide accessories as recommended by the Condensing Unit Manufacturer.

2.04 REFRIGERANT

2.05 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.06 VALVES

- A. Service Valves:
 - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.07 FILTER-DRIERS

- A. Performance:
 - 1. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
 - 2. Design Working Pressure: 350 psi, minimum.
- B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
- C. Construction: UL listed.

1. Connections: As specified for applicable pipe type.

2.08 EXPANSION VALVES

- A. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.
- B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.09 FLEXIBLE CONNECTORS

- A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
 1. Install in accordance with ASME B31.5.
 2. Provide oversized hangers on insulated pipe to allow insulation at full thickness to be provided on the piping.
 3. Support horizontal piping as indicated.
 4. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 5. Place hangers within 12 inches of each horizontal elbow.

3.03 FIELD QUALITY CONTROL

- A. Test refrigeration system in accordance with ASME B31.5.
- B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

END OF SECTION

**SECTION 232500
CHEMICAL WATER TREATMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Materials.
 - 1. System cleaner.
 - 2. Closed system treatment (water).
- B. Side-stream filtration equipment.
- C. Glycol.

1.02 SUBMITTALS

- A. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- B. 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.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Sufficient chemicals for treatment and testing during required maintenance period.

1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.04 MAINTENANCE SERVICE

- A. Furnish service and maintenance of treatment systems for one year from Date of Substantial Completion.
- B. Provide semi-annual technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.
- C. Provide laboratory and technical assistance services during this maintenance period.
- D. Include two hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.

1.05 MAINTENANCE MATERIALS

- A. Supply sufficient chemicals for treatment and testing during warranty period.

PART 2 PRODUCTS

2.01 GLYCOL SYSTEM

- A. Mixing Tank and Transfer Pump: 55 gallon plastic chemical drum with fittings suitable for filling. Self priming pump to transfer chemicals from drum to system. Pump shall be Dayton #2P390 or equivalent 1/2 hp, 120 volt, single phase, ODP motor with automatic reset thermal protection, provide minimum 8 foot cord and plug. Provide with hose for connection
 - 1. Provide with flexible hose for connection from mixing tank to system fill locations when project is complete.
 - 2. Mixing tank shall be left 75% full (minimum) of glycol mixture upon completion of project.
- B. Glycol Solution:
 - 1. Manufacturers:
 - a. DOW
 - b. Rhomar Water Management
 - c. Interstate
 - 2. Inhibited propylene glycol and water solution mixed 35 percent glycol - 65 percent water, suitable for operating temperatures from -15 degrees F to 200 degrees F. Burst protection

to -40 degrees F. The solution shall have a pH between 8.0 and 9.0, a reserve alkalinity of 6.6ml HCl/10ml, no flash point, no silicates and a fluorescent color.

3. The de-ionized water used to dilute the concentrate and the pre-mixed solutions, if necessary, shall contain less than: 100 ppm calcium carbonate hardness 40 ppm calcium plus magnesium ions 50 ppm chloride plus sulfate ions.
4. The heat transfer fluid shall be an inhibited glycol-based industrial heat transfer fluid specifically formulated for use in HVAC SYSTEMS. The fluid must contain corrosion inhibitors and buffers and an antifoam agent, necessary for long fluid and system life.
5. COMMERCIAL AUTOMOBILE ANTIFREEZE SOLUTIONS, UNINHIBITED GLYCOL OR FIELD INHIBITED GLYCOL IS NOT ACCEPTABLE.
6. The system shall have a nameplate and shall contain the following information:
 - a. Date of original Heat Transfer Fluid charge
 - b. Description of Heat Transfer Fluid
 - c. Manufacture's Name, Address and Telephone
 - d. Percentage and Type of Glycol
 - e. Freeze Point & Burst Point
 - f. Total System Gallons
 - g. Reference to Material Safety Sheet
 - h. Instructions for Sampling of Fluid
 - i. Month for Annual Sampling
 - j. Mailing Instructions to independent testing laboratory
7. Provide additional inhibitors as recommended by manufacturer if glycol percentage is below manufacturers recommendations.

2.02 MATERIALS

- A. System Cleaner:
 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
- B. Closed System Treatment (Water):
 1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
 2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
 3. Conductivity enhancers; phosphates or phosphonates.

2.03 SIDE-STREAM FILTRATION SYSTEM

- A. System: Flow indicator (Dwyer HF or equivalent), filter housing with cartridge filter, shut-off valves, and flow control valve.
- B. Hot Water and Glycol Filter Housing: Glass reinforced nylon plastic or stainless steel suitable for 220 degrees F and 125 psi operating conditions.
- C. Cartridges: 30 micron for start-up and 5 micron for system operation.

PART 3 EXECUTION

3.01 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.

3.02 FLUSHING SEQUENCE

- A. Flush all dirt and debris using potable water flowing at twice the normal operating flow rate (velocities of 8 feet per second, minimum) for a minimum of four hours or until no dirt or debris is visible, whichever is longer. If the building system pumps are used for flushing of the system, new pump seals shall be provided after system water treatment has been completed.

3.03 CLEANING SEQUENCE

- A. Concentration:
 - 1. As recommended by manufacturer.
- B. Hot Water Heating Systems:
 - 1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
 - 2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
 - 3. Circulate for 6 hours at design temperatures, then drain.
 - 4. Refill with clean water and repeat until system cleaner is removed.
- C. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.
- D. Remove, clean, and replace strainer screens.
- E. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.04 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.05 CLOSED SYSTEM TREATMENT

- A. Provide minimum of one system fill location for each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
- B. After the system is filled and the air is properly purged, allow the fluid to circulate for minimum 24 hours. Then, pull a sample using the sample kit provided by the manufacturer.
- C. The analysis from the manufacturer should list the following:
 - 1. pH, Color, Clarity
 - 2. Reserve Alkalinity, ml
 - 3. Inhibitors: Ferrous, Copper & Brass Corrosion Products
 - 4. Degradation Products
 - 5. Corrosives
 - 6. Scale Promoters
 - 7. Contaminants

3.06 GLYCOL SYSTEMS

- A. Clean and flush glycol system before adding glycol solution.
- B. Feed glycol solution to system through make-up line with pressure regulator, venting system high points.
- C. After the system is filled and the air is properly purged, allow the fluid to circulate for minimum 24 hours. Then, pull a sample using the sample kit provided by the manufacturer. Provide report to Engineer and Architect.
- D. Contractor shall pull a second sample six months after the initial fill, and on the anniversary of the fill. Samples shall be sent to the manufacturer for analysis.
- E. The flushing, filling and glycol for the entire hydronic system including the ground coupled heat exchanger shall be responsibility of section 23 2500 HVAC Water Treatment.
- F. The analysis from the manufacturer should list the following:
 - 1. Concentration, vol %
 - 2. Freeze Point, Degrees F
 - 3. pH, Color, Clarity
 - 4. Reserve Alkalinity, ml
 - 5. Inhibitors: Ferrous, Copper & Brass Corrosion Products

6. Degradation Products
 7. Corrosives
 8. Scale Promoters
 9. Contaminants
- G. Manufacturer report shall be submitted to the Engineer for the inclusion in the building submittal records for distribution to the Owner.

END OF SECTION

**SECTION 233100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.
- C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.
- D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.
- F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- G. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.
- H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.03 SUBMITTALS

- A. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).
- B. Duct Construction Report: Provide submittal detailing duct construction requirements. Provide duct fittings, duct gages, internal/external reinforcements, drives, etc. to meet SMACNA (DCS) construction criteria for each pressure class listed in this section. Provide with applicable SMACNA tables.
- C. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

1.05 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- C. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

- D. Insulated Flexible Ducts:
 - 1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
 - a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
 - b. Maximum Velocity: 4000 fpm.
 - c. Temperature Range: -20 degrees F to 210 degrees F.
 - d. Insulation: Refer to HVAC Insulation Spec Section for insulation requirements.
- E. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - 1. 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.
 - 2. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.

2.02 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Construct T's, 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 air foil turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.03 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMANCA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing and sealing for operating pressures indicated.
- B. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
 - 1. Manufacture in accordance with SMACNA (DCS).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Duct sizes indicated are inside clear dimensions.
- E. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- F. Provide turning veins in all rectangular elbows as indicated on plans and/or if either duct dimension is 12" or larger . Transfer duct elbows do not require turning veins.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

- H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- I. Use double nuts and lock washers on threaded rod supports.
- J. Do not use flexible duct to change direction.
- K. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.
- L. Connect flexible ducts to metal ducts per detail located on drawings
- M. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.
- N. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- O. At exterior wall louvers, seal duct to louver frame and install blank-out panels.
- P. If test and balance report shows the duct traverse at the fan to be 10% or higher than the sum of the outlets, the contractor shall be required to re-seal ductwork to reduce leakage to less than 10%. Contractor shall be responsible for removing and replacing ceiling tiles, removing and replacing duct insulation and all other work required to re-seal ductwork.

3.02 SCHEDULES

- A. Ductwork Pressure Class:
 - 1. Constant Volume Air Handling Unit Systems
 - a. Supply main ducts, 2 inch w.g.
 - b. Return main ducts, 1 inch w.g.
 - c. Branch ductwork, 0.5 inch w.g.
 - d. Outside air and relief air ductwork, 1 inch w.g.
 - 2. Exhaust Fans
 - a. Main central exhaust ducts, 1 inch w.g.
 - b. Branch ductwork and ceiling exhaust fans, 0.5 inch w.g

END OF SECTION

**SECTION 233300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers.
- C. Duct access doors.
- D. Duct test holes.
- E. Fire dampers.
- F. Flexible duct connectors.
- G. Volume control dampers.

1.02 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
- D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- B. Manufacturer's Installation Instructions: Provide instructions for fire dampers, smoke dampers, combination fire and smoke dampers, smoke dampers, and smoke dampers.
- C. Project Record Drawings: Record actual locations of access doors and test holes.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Fusible Links: One of each type and size.

1.04 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.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS

- A. Manufacturers:
 - 1. Greenheck
 - 2. Nailor Industries Inc: www.nailor.com.
 - 3. Ruskin Company: www.ruskin.com.
 - 4. Pottorff: www.pottorff.com.
 - 5. Aire Technologies, Inc.

6. Tamco

- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

- A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
1. Up to 24 inches square: Provide paired camlocks.
 2. Larger than 24 inches: Provide hinge and compression latches.
- B. Access doors with sheet metal screw fasteners are not acceptable.

2.04 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.

2.05 FIRE DAMPERS

- A. Manufacturers:
1. Greenheck: www.greenheck.com
 2. Louvers & Dampers, Inc: www.louvers-dampers.com.
 3. Nailor Industries Inc: www.nailor.com.
 4. Ruskin Company: www.ruskin.com.
 5. Pottorff: www.pottorff.com.
 6. Aire Technologies, Inc.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Dampers shall be dynamic rated. All hardware necessary for the U.L listed installation including sleeves, angles, clips, etc. shall be provided by the damper manufacturer.
- D. Horizontal Dampers: Galvanized steel, 22 gage, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.
- F. Fusible Links: UL 33, separate at 165 degrees F.

2.06 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
 - a. Net Fabric Width: Approximately 2 inches wide.

2.07 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Single Blade Dampers:
- C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

- D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- E. 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 provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to 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. If there are conflicts to this minimum access for any damper, contact the Engineer for review. Refer to the drawings and details for size of panels. Where no size is indicated on the drawings, hand access shall be minimum 8" x 8" and shoulder access shall be minimum 24" x 24".
- D. Provide turning veins in all rectangular elbows as indicated on plans and/or if either duct dimension is 12" or larger . Transfer duct elbows do not require turning veins.
- E. Provide duct test holes where indicated and required for testing and balancing purposes.
- F. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- G. Verify operation of all smoke and combination fire/smoke dampers. Provide documentation of testing.
- H. Demonstrate re-setting of fire dampers to Owner's representative.
- I. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- J. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- K. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.
- L. 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 2 duct widths from duct take-off.
- M. Provide control dampers as indicated on the drawings.
- N. 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

**SECTION 233423
HVAC POWER VENTILATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof exhausters.

1.02 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
- B. AMCA 99 - Standards Handbook; 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005 (Reaffirmed 2012).
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.
- G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2017.
- H. UL 705 - Power Ventilators; Current Edition, Including All Revisions.
- I. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Fan Belts: One set for each individual fan.

1.04 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Greenheck / Accurex
- B. Loren Cook Company: www.lorencook.com.
- C. Twin City Fan & Blower: www.tcf.com/#sle.

2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Provide phase monitors and brown out protection on all three phase units.

H. Hood Exhaust Fans: Comply with requirements of NFPA 96.

2.03 ROOF EXHAUSTERS

- A. Performance Ratings: Refer to drawings.
- B. Downblast Fan Unit: V-belt or direct driven as indicated, with spun aluminum leak proof housing; non-overloading, backward inclined centrifugal, statically and dynamically balanced, matched wheel cone and fan inlet, resilient mounted open driproof motor, permanently sealed bearings, 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- C. Roof Curb: 24 inch high self-flashing of 18 gauge galvanized steel with continuously welded seams, built-in wood nailers with lapped joints, R-10 fiberglass insulation secured at top and bottom with insulation tray. Verify pitch of roof and provide pitched curb as required.
- D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.
- E. Provide phase monitors and brown out protection on all three phase units.
- F. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked
- G. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Provide sheaves required for final air balance.
- E. Install backdraft dampers on inlet to roof and wall exhausters.

END OF SECTION

**SECTION 233700
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
- B. Rectangular ceiling diffusers.
- C. Slot ceiling diffusers.
- D. Registers/grilles:
 - 1. Ceiling-mounted, egg crate exhaust and return register/grilles.
 - 2. Wall-mounted, supply register/grilles.
 - 3. Wall-mounted, exhaust and return register/grilles.
- E. Louvers:

1.02 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (Reaffirmed 2011).
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.03 SUBMITTALS

- A. 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.

1.04 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS - GRILLES & DIFFUSERS

- A. Price Industries: www.price-hvac.com/#sle.
- B. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.
- C. Nailor
- D. Pottorff
- E. Tuttle & Bailey

2.02 SQUARE CONE CEILING DIFFUSERS

- A. Type: Die formed with smooth surfaces and no corner joints. Three concentric cones. Adjustable pattern controllers where indicated on the schedule on the drawings.
- B. Frame: Refer to the reflected ceiling plans. Where the ceiling is gypsum board, provide plaster frame and ceiling frame. Confirm the type of tees for lay-in tile ceilings in the Architects specification. Provide frame for narrow tee ceilings if required.
- C. Fabrication: Steel with steel frame and baked enamel off-white finish, unless otherwise noted on the drawings.
- D. Accessories: Refer to schedule on the drawings for requirements of opposed blade balancing dampers, radiation dampers and fire blankets.

2.03 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch louvers.

- B. Fabrication: Aluminum with factory off-white enamel finish.
- C. Frame: Channel lay-in frame for suspended grid ceilings. Where the ceiling is gypsum board, provide plaster frame and ceiling frame. Confirm the type of tees for lay-in tile ceiling in the Architects specification. Provide frame for narrow tee ceiling if required.
- D. Accessories: Refer to schedule on the drawings for requirements of opposed blade balancing dampers, radiation dampers and fire blankets.

2.04 SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel finish. Note: grilles not located in the same room may be selected in different colors.
- D. Accessories: Refer to schedule on the drawings for requirements of opposed blade balancing dampers, radiation dampers and fire blankets.

2.05 EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting.
- C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel finish. Note: grilles not located in the same room may be selected in different colors.
- D. Accessories: Refer to schedule on the drawings for requirements of opposed blade balancing dampers, radiation dampers and fire blankets.

2.06 LOUVERS

- A. Manufacturers:
 - 1. Greenheck
 - 2. Ruskin
 - 3. Arrow
 - 4. Louvers & Dampers
 - 5. Nailor
 - 6. Pottorff
- B. Type: 4 inch deep with blades on 45 degree slope with heavy channel frame and birdscreen attached to the back of the louver.
- C. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory baked enamel finish custom color to be selected.
 - 1. Each louver may be selected in a different color.
- D. Mounting: Furnish with interior flat flange for installation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers.
- E. Paint ductwork visible behind air outlets and inlets matte black.

- F. Inside the building, where sidewall return or exhaust grilles are mounted entirely above six feet above finished floor, install them in inverted position for sight-proof.

END OF SECTION

**SECTION 235234
FINNED MODULAR BOILERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Boilers.
- B. Controls and boiler trim.
- C. Hot water connections.
- D. Fuel connection.
- E. Emergency Shutdown Switches.

1.02 REFERENCE STANDARDS

- A. ANSI Z21.13 - American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers; 2010.
- B. ASME (BPV IV) - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; The American Society of Mechanical Engineers; 2007.
- C. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2007.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- E. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2009.
- F. NFPA 58 - Liquefied Petroleum Gas Code; National Fire Protection Association; 2011.
- G. UL (HCVCE) - Heating, Cooling, Ventilating and Cooking Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.03 SUBMITTALS

- A. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements.
- B. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum ten years of documented experience.

1.05 REGULATORY REQUIREMENTS

- A. Conform to ASME (BPV IV) and (BPV VIII,1) for boiler construction.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

1.07 EXTRA MATERIALS

- A. Provide one additional set of combustion air filters.

1.08 WARRANTY

- A. Provide a five year warranty to include coverage for heat exchangers.
- B. Provide a one year warranty on the burner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Lochinvar Corporation: www.lochinvar.com. - Knight XL
- B. Burnham/Thermal Solutions - Apex
- C. Fulton - Endura XE

2.02 MANUFACTURED UNITS

- A. Sealed combustion hot water boiler with stainless steel finned tube heat exchanger, gas burning system, combustion chamber, controls and boiler trim.
- B. Performance: See schedule on plans.

2.03 FABRICATION

- A. Assembly: Stainless steel tube heat exchanger assembled within combustion chamber conforming to ASME (BPV IV) and (BPV VIII, 1) requirements, and tested for maximum working pressure of 160 psi.
- B. Combustion Chamber: Stainless steel metal-mesh burner enclosed in stainless steel with a fully water-backed tube sheet heat exchanger.
- C. Jacket: Galvanized steel with factory applied powder coat finish, insulated with foil faced fiberglass insulation.

2.04 FUEL BURNING SYSTEM

- A. Sealed Combustion Gas Burner: Stainless steel metal-mesh burner with no moving parts, full modulation with minimum 5:1 turn down utilizing a VFD and negative pressure regulation gas valve, interrupted-type mixed fuel/air pilot system with electric spark-to-pilot ignition, pilot proving device, manual shut-off and automatic main and redundant 100% safety gas shut-off valves, high and low gas pressure switches, blower, replaceable combustion air filter and combustion air pressure switch.
- B. 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 air flow proven allow gas valve to open. Conform to requirements of UL 795 and CSD-1.
- C. Corrosion resistant stainless steel condensate collection/evaporation components.
- D. Venting: Polypropylene piping rated for venting gas fired equipment.
- E. Air Intake: PVC piping.
- F. Provide factory concentric vent kit. Refer to drawings for roof or wall termination.

2.05 TRIM

- A. ASME rated pressure relief valve set at 50 psi.
- B. Low water cut-off and inlet flow switch to automatically prevent burner operation when water falls below safe level or on low flow through boiler.
- C. Provide unit mounted water pressure and temperature gauge.

2.06 CONTROLS

- A. Operating Controls: Smart System control with multi-colored graphic lcd display, pre-wired, factory assembled electric control including pilot safety and thermocouple transformer, 24-volt gas valve, manual main and pilot valves, and junction box.
- B. Electronic operating temperature controller:
 - 1. NEMA 250 Type 1 enclosure installed on boiler.

2. Ambient temperature range -30 to 150 degrees F.
 3. Adjustable reset ratio of outside air temperature change to discharge control point change 1:2 to 100:1.
 4. Integral set point adjustment 80 to 230 degrees F.
 5. Electronic primary and outdoor sensors.
 6. Built-in sequencing options for lead-lag or efficiency optimized modulation logic with rotation.
 7. Two terminal strips for safety and operating controls and integral relays for pump control.
- C. High limit temperature controller with manual reset for burner to prevent boiler water temperature from exceeding safe system temperature.

2.07 EMERGENCY SHUTDOWN SWITCHES

- A. ADA compliant emergency power off push button switch station. Provide with red push switch. Rated for indoor/outdoor use as required. Designed for single gang box installation.
1. Provide switch/switches for boilers at boiler rooms doors. Coordinate exact switch locations and quantity with local boiler inspector.
- B. Label for use and provide with clear (lift to open) cover.
- C. Provide all associated wiring and controls as required for a complete system.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install boiler and provide connection of liquified petroleum gas service in accordance with requirements of NFPA 58 and applicable codes.
- C. Maintain manufacturer's recommended clearances around and over equipment and as required by local code.
- D. Arrange all electrical conduit, piping, exhaust vent, and air intake with clearances for burner removal and service of all equipment.
- E. Connect exhaust vent and air inlet to boiler.
- F. Connect gas, supply and return water connections.
- G. Pipe relief valves and condensate to nearest floor drain.

3.02 SYSTEM STARTUP

- A. Provide minimum of 4 hours of operation and maintenance training for owner personnel.
- B. Provide the services of manufacturer's field representative for starting and testing boiler to manufacturers guidelines. Coordinate startup with all trades.

END OF SECTION

**SECTION 235533
FUEL-FIRED UNIT HEATERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Gas fired unit heaters.

PART 2 PRODUCTS

2.01 GAS FIRED UNIT HEATERS

- A. Manufacturers:
 - 1. Modine Manufacturing Company: www.modine.com/#sle.
 - 2. Sterling HVAC/Mestek Technology, Inc: www.sterlinghvac.com/#sle.
 - 3. Reznor/Thomas & Betts Corporation: www.reznorhvac.com/#sle.
 - 4. Rapid Engineering
- B. Unit Heaters: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, controls, and accessories:
 - 1. Heating: Propane gas fired.
 - 2. Discharge Louvers: Individually adjustable horizontal and vertical louvers to match cabinet finish.
- C. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.
- D. Supply Fan: Propeller type with direct drive, variable pitch motor pulley.
- E. Heat Exchanger: Aluminized steel welded construction.
- F. Gas Burner:
 - 1. Atmospheric type with adjustable combustion air supply.
 - 2. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
 - 3. Electronic pilot ignition, with electric spark igniter.
- G. Gas Burner Safety Controls:
 - 1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
 - 2. Vent Safety Shutoff Sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
- H. Operating Controls:
 - 1. Room Thermostat: Cycles burner to maintain room temperature setting.
- I. Performance:
 - 1. Ratings: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1 I-P; seasonal efficiency to ASHRAE Std 103.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with NFPA 90A.
- B. Install gas fired units in accordance with NFPA 54 and applicable codes.
- C. Provide vent connections in accordance with NFPA 211.

END OF SECTION

SECTION 237413 ROOFTOP UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged roof top unit.
- B. Unit controls.
- C. Roof mounting curb and base.

1.02 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

1.03 SUBMITTALS

- A. 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.
- B. Shop Drawings: Indicate 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. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- 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. Extra Filters: Provide new set filters after substantial completion and provide one additional set of filters for each.

1.04 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.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.06 WARRANTY

- A. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp: www.carrier.com.
- B. Trane, a brand of Ingersoll Rand: www.trane.com.
- C. Johnson Controls/York
- D. Mcquay/Daikin
- E. Aaon
- F. Lennox

2.02 MANUFACTURED UNITS

- A. General: Roof mounted units having gas burner and electric refrigeration.

- B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, relief fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil with hail guards and condenser fan.
- C. Provide phase monitors and brown out protection on all three phase units.
- D. Disconnect Switch: Factory mount disconnect switch.

2.03 FABRICATION

- A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gage, 0.0478 inch, with access doors or panels of minimum 20 gage, 0.0359 inch.
- B. Insulation: 1/2 inch thick foil faced glass fiber with edges protected from erosion.
- C. Heat Exchangers: Aluminized steel, of welded construction.
- D. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted high efficiency motor or direct drive as indicated. Isolate complete fan assembly.
 - 1. Provide all units with powered relief fans.
- E. Provide with economizer and associated economizer controls. Provide with intake hood on outside air intake.
- F. Roof Mounting Curb: 24 inches high insulated galvanized steel, channel frame with gaskets, nailer strips.

2.04 BURNER

- 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 shut-off 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 air flow proven and slight delay, allow gas valve to open.

2.05 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 capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.06 COMPRESSOR

- 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.
- B. Provide with hot gas reheat, associated reheat coil and controls.

2.07 CONDENSER COIL

- A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil hail guard.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

2.08 MIXED AIR CASING

- A. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper to fall to closed position. Relief dampers may be gravity balanced.

2.09 AIR FILTER

- A. Refer to plans and schedule for filter requirements.

2.10 OPERATING CONTROLS

- A. Provide low voltage, adjustable room thermostat to control burner operation, compressor and condenser fan, and supply fan to maintain temperature setting.
 - 1. Include system selector switch (heat-off-cool) and fan control switch (auto-on).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 90A.
- C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 SYSTEM STARTUP

- A. Provide a factory trained start-up. Include at least 8 hours of time for coordination with the temperature controls contractor.
- B. Prepare and start equipment. Adjust for proper operation.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate operation to Owner's maintenance personnel.

3.05 MAINTENANCE

- A. Provide service and maintenance of packaged roof top units for one year year from Date of Substantial Completion.
- B. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibration.
- C. After each service call, submit copy of service call work order or report that includes description of work performed.

3.06 DEMONSTRATION

- A. Provide on-site training course of 4 hours shall be provided by a representative of the unit manufacturer to plant and/or maintenance personnel.

END OF SECTION

**SECTION 238126
SPLIT-SYSTEM HEATING AND COOLING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Air cooled condensing units.
- C. Indoor air handling (fan and coil) units for ductless systems.
- D. Controls.

1.02 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.
- B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.
- C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants; 2019, with Errata (2020).
- D. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant; 2019.
- E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
- F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.
- G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- C. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 WARRANTY

- A. Provide three year manufacturers warranty for solid state ignition modules.
- B. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Panasonic
- B. GREE
- C. LG
- D. Mitsubishi
- E. Sanyo
- F. Daikin
- G. Haier
- H. GE
- I. Hitachi

J. Samsung

2.02 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. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.
 - 2. 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.
 - 1. Efficiency: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1; seasonal efficiency to ASHRAE Std 103.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
 - 1. Filter return air with washable filter.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
 - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
 - 2. Manufacturer: System manufacturer.
- C. Integral condensate pump with overflow protection.

2.04 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 23.1 and UL 207.
- B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.
- C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- D. 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.
- E. Operating Controls:
 - 1. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

2.05 THERMOSTATS

- A. Room Thermostat: Wall mounted, wired low voltage, controlling heat and fan to maintain temperature setting; with system selector switch (heat-cool-off) and fan control switch (auto-off). Provided by manufacturer of unit.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

D. Install condensing unit on roof rails provided by general contractor.

E. Pipe drain from cooling coils to nearest floor drain.

END OF SECTION

**SECTION 260500
BASIC ELECTRICAL REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Basic Electrical Requirements applicable to Division 26, Division 27, and Division 1 - General Requirements.

1.02 REFERENCES

- A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- B. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2016.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2020.

1.03 DEFINITIONS

- A. The meaning and intent of the word "provide" as used in these specifications is the same as the words "The Electrical Contractor (and/or Bidder) shall provide."
- B. The word "provide" shall carry the same meaning as "furnish and install."
- C. The word "Contractor" shall mean the "Electrical Contractor."

1.04 PERFORMANCE REQUIREMENTS

- A. Conform to all applicable Building Codes, ordinances, laws and regulations.
- B. Electrical: Conform to NFPA 70 - National Electrical Code.
- C. Furnish products listed and classified by Underwriters Laboratories Inc.®, as suitable for the purpose specified and shown.
- D. Obtain permits, and request inspections from authority having jurisdiction.
- E. If the drawings and/or specifications conflict with any regulatory requirement, the regulatory requirement shall be followed. This does not relieve the Contractor from complying with items in the drawings and/or specifications in excess of the regulatory requirements.
- F. Test Standards:
 - 1. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc.®, standards where test standards have been established. Equipment and materials which are not covered by UL® Standards will be accepted provided the equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory acceptable to the authority having jurisdiction.
 - 2. Definitions:
 - a. Listed; equipment or device of a kind mentioned which:
 - 1) Is published by a nationally recognized laboratory which makes periodic inspection of production of such equipment.
 - 2) States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.
 - b. Labeled; equipment or device is when:
 - 1) It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters Laboratories Inc.®
 - 2) The laboratory makes periodic inspections of the production of such equipment.
 - 3) The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.
 - c. Certified; equipment or product is which:
 - 1) Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - 2) Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.

- 3) Bears a label, tag, or other record of certification.
- d. Nationally recognized testing laboratory; laboratory which is approved by the authority having jurisdiction.

1.05 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit product data grouped to include complete submittals of related systems, products, and accessories.
- C. Shop Drawings: Submit Shop Drawings grouped to include complete submittals of related systems, products, and accessories.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Mark dimensions and values in units to match those specified.

1.07 DRAWINGS

- A. The drawings indicate the general arrangement and extent of electrical work. Do not scale off the electrical drawings. All data shall be field verified with actual field conditions. Review drawings of other trades and adjust work to meet the requirements of conditions shown.
Contractor shall be responsible to field measure and confirm mounting heights and location of electrical equipment with respect to counters, radiation and other Architectural, Mechanical or Structural work. Coordinate site electrical equipment with the site utilities to ensure electrical equipment is not installed above underground site utilities.
- B. The drawings and specifications are complementary each to the other. What is called for by one shall be as binding as if called for by both.
- C. Omissions or discrepancies between different drawings or between drawings and specifications or between contract documents and regulations and/or codes shall be brought to the attention of the Architect/Engineer for a decision in writing. Interpretation before the bid shall be by addendum only. If an interpretation is not given by addendum, bid the greater quantity or better quality.

1.08 PERMITS AND LICENSES

- A. Obtain and pay for required licenses and permits. Pay for fees and charges for connection to outside services. Coordinate costs for electrical service including transformers, telephone service, cable TV service during the bidding phase of the project. Pay for use of property other than the site of the work for storage of materials or other purposes.
- B. Installation shall be performed by persons licensed and skilled in the trade, and shall be done under the supervision of a master electrician licensed by the State.

1.09 PROGRESS OF WORK

- A. Organize electrical work such that the progress of the work will conform to the progress of other trades, and complete the entire installation as soon as the conditions of the building will permit.
Any cost resulting from defective or ill-timed work performed under this section shall be borne by this Contractor.
- B. Portions of work will be required to be accomplished during other than normal working hours.

1.10 CORRELATION OF WORK

- A. Organize work so that it will not interfere with the work of other trades. Consult the drawings and specifications for work of other trades to correlate information, and consult the architectural

and structural drawings for details and dimensions. Verify the location of all outlets. If interference develops, bring it to the attention of the Architect/Engineer for a decision. No additional compensation will be allowed for the moving of misplaced outlets, wiring or equipment.

- B. Before roughing-in for electrical equipment furnished by others, verify the voltage and current characteristics and control connections of this equipment, and provide the proper feeders and connections as recommended by the manufacturer of the equipment.
- C. Site Work: The contractor shall be responsible for locating and staking the locations for all light poles and other electrical equipment indicated on the electrical site drawings. The site drawing is not to be scaled for location, exact staked locations are to be provided. The contractor shall employ a surveyor to stake the locations based on the site drawing coordinates provided by the design engineer.

1.11 CUTTING AND PATCHING

- A. Lay out all work in advance and where removal of door frames, portions of walls, ceilings or floors are required, and cutting, channeling, chasing, or drilling of building surfaces is necessary for the proper installation of electrical equipment, carefully perform this work in a manner which does not weaken floors and walls. Damaged surfaces shall be repaired at no cost to the Owner.
- B. Concrete shall be cut only with rotary type drilling tools. Electrical equipment shall not be cut with torches, and shall be joined only by bolting (i.e., do not weld wireways to panels).
- C. Patching, when required, shall be finished to match adjoining surfaces and is subject to approval by the Architect/Engineer.

1.12 EXAMINATION OF SITE

- A. Before submitting a bid, each bidder shall examine the site, check the means of installing electrical equipment within the building, making connections to services, and shall be familiar with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or lack of knowledge of any site conditions which may affect the work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Architect/Engineer before submitting a bid.

1.13 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 01 78 00.
- B. Format:
 - 1. Prepare data in the form of an instructional manual.
 - 2. Organize in commercial quality, 8-1/2" x 11", three-ring binders with hard black or white, cleanable, plastic covers. When multiple binders are used, correlate data into related consistent groupings.
 - 3. Identify each binder on cover with typed or printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," list title of Project and identify subject matter of contents.
 - 4. Arrange contents by section numbers and sequence of Table of Contents by this Project Manual.
 - 5. Provide tabbed flyleaf for each separate product and system, with typed description of product and major component parts of equipment.
 - 6. Text: Manufacturer's printed data or typewritten data on 20-pound paper.
 - 7. Drawings: Provide with reinforced punched binder tab. Bind in with text. Fold larger drawings to size of text pages.
- C. Contents of Each Volume:
 - 1. Table of Contents: Provide title of Project; names, addresses and telephone numbers of Engineer and Contractor and listing of products and systems indexed to tabbed flyleaves.
 - 2. Updated Subcontractor, Supplier and Manufacturer List: Indicate any changes made after original submission at start of Project.

3. Include description as to type and quantity of maintenance materials turned over to Owner in accordance with individual sections.
 4. Warranties and Bonds: Include all.
 5. Shop Drawings and Product Data: Include only those so required by individual sections.
 6. Operation and Maintenance Data for Equipment and Systems: Where required by individual sections, provide manufacturer's recommended operation procedures and maintenance requirements including guide for troubleshooting, disassembly, repair and assembly instructions and alignment, adjusting, balancing and checking instructions.
 7. Include a copy of ANSI/NFPA 70B Electrical Equipment Maintenance.
- D. Submittals:
1. Submit one copy of completed volumes in final form 15 days prior to final inspection. Copy will be returned after final inspection, with Engineer's comments. Revise contents of documents as required prior to final submittal.
 2. Submit two copies of revised volumes of data in final form to Engineer within ten days after final inspection.

1.14 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle Products to site under provisions of Section 01 60 00.

1.15 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 01 78 00.
- B. Include all changes and deviations from contract documents. Clearly mark in red colored pencil. Include all addendum items and approved change orders.

1.16 MINIMUM REQUIREMENTS

- A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), National Fire Protection Association (NFPA), National Electrical Installation Standards (NEIS), and any other applicable standards are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

END OF SECTION

**SECTION 260519
LOW VOLTAGE WIRING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Heat shrink tubing.
- F. Wire pulling lubricant.
- G. Cable ties.
- H. Firestop sleeves.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260526 - Grounding and Bonding: Additional requirements for grounding conductors and grounding connectors.
- C. Section 260553 - Electrical Identification: Identification products and requirements.
- D. Section 262100 - Electrical Service Entrance: Additional requirements for electrical service conductors.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- F. IEEE 1210 - IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable; 2004 (Corrigendum 2014).
- G. IEEE 1210 - IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable; 2004 (Corrigendum 2014).
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- I. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.
- N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

- P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.
- R. ASTM B836 - Standard Specification for Compact Round Stranded Aluminum Conductors using Single Input Wire Construction (2015).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.
- B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:

- a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet.

H. Manufactured wiring systems are not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide conductors and cables with lead content less than 300 parts per million.
- D. Provide new conductors and cables manufactured not more than one year prior to installation.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- F. Comply with NEMA WC 70.
- G. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- H. Conductors for Grounding and Bonding: Also comply with Section 260526.
- I. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.
- J. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- K. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- L. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 2. Control Circuits: 14 AWG.
- M. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- N. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - b. Equipment Ground, All Systems: Green.
 - c. Travelers for 3-Way and 4-Way Switching: Pink.

- d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
- e. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. General Cable Technologies Corporation: www.generalcable.com/#sle.
 - d. Service Wire Co: www.servicewire.com/#sle.
 - e. Southwire Company: www.southwire.com/#sle.
 - f. Or Equal.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
 - 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN-2 or XHHW-2.

2.04 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 - 2. Encore Wire Corporation: www.encorewire.com/#sle.
 - 3. Service Wire Co: www.servicewire.com/#sle.
 - 4. Southwire Company: www.southwire.com/#sle.
 - 5. Cerrowire.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN/THWN-2 or XHHW-2.
- F. Provide dedicated neutral conductor for each phase conductor.
- G. Grounding: Full-size integral equipment grounding conductor.
- H. Armor: Aluminum or steel, interlocked tape.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 260526.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 7. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - c. NSI Industries LLC: www.nsiindustries.com/#sle.
 - d. Or Equal.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
 - a. Burndy LLC: www.burndy.com.
 - b. nVent ILSCO: www.ilSCO.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Or Equal.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
 - a. Burndy LLC: www.burndy.com.
 - b. nVent ILSCO: www.ilSCO.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Or Equal.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
 - a. Burndy LLC: www.burndy.com.
 - b. IlSCO: www.ilSCO.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Or Equal.

2.06 ACCESSORIES

- A. Electrical Tape:
1. Manufacturers:
 - a. 3M: www.3m.com/#sle.

- b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
 - c. Or Equal.
 - 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 - 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
 - 4. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
 - 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Burndy LLC: www.burndy.com.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Or Equal.
- C. Wire Pulling Lubricant:
 - 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. American Polywater Corporation: www.polywater.com/#sle.
 - c. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - d. Or Equal.
 - 2. Listed and labeled as complying with UL 267.
 - 3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 - 4. Suitable for use at installation temperature.
- D. Cable Ties: Material and tensile strength rating suitable for application.
 - 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com.
 - b. Or Equal.
- E. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
 - 1. Products:
 - a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
 - b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.
 - c. Or Equal.
- F. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
 - 1. Products:
 - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.
 - b. Or Equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.

- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
 - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
 - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120 and per the Manufacturer's Instructions.
- E. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
 - a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
 - c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
- I. Install conductors with a minimum of 12 inches of slack at each outlet.
- J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- M. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
 2. Damp Locations: Use insulating covers specifically designed for the connectors or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 3. Wet Locations: Use heat shrink tubing.
- O. Insulate ends of spare conductors using vinyl insulating electrical tape.
- P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- Q. Identify conductors and cables in accordance with Section 260553.
- R. Color Code Legend: Provide identification label identifying color code for ungrounded conductors 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.
- S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. Correct deficiencies and replace damaged or defective conductors and cables.
- B. Inspect wire for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.

END OF SECTION

**SECTION 260526
GROUNDING AND BONDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Grounding and bonding components for electrical systems.
- G. Grounding and bonding components for communications systems.

1.02 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.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System; 1983.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; National Electrical Manufacturers Association; 2007.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 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.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.
- C. ANSI/TIA J-STD-607A Commercial Building Grounding and Bonding Requirements for Telecommunications.
- D. NECA/BICSI 607-2011 Standard for Telecommunications Bonding and Grounding, Planning and Installation Methods for Commercial Buildings.
- E. IEEE 1100 - Recommended Practices for Powering and Grounding Electronic Equipment.

1.05 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 5 ohms.

1.06 SUBMITTALS

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

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Test Reports: Indicate overall resistance to ground .
- D. Field quality control test reports.
- E. Project Record Documents: Record actual locations of grounding electrode system components and connections.
- F. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- C. Comply with UL 467.
- D. Comply with NECA's "Standard of Installation."

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. 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.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. 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.
 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested according to IEEE 81 using "point-to-point" methods.
- E. 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. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Metal Building or Structure Frame:
 - a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet 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.
 5. 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 from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) below the switchboard concrete equipment pad and conceal the electrodes and interconnecting conductors within the switchboard or locate at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
 8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 8. Provide bonding for interior metal air ducts.
 9. Provide bonding for metal building frame where not used as a grounding electrode.
 10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
- H. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
 2. Provide bonding jumper from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 3/0 AWG unless noted otherwise.
 - b. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or Intertek (ETL) as suitable for the purpose indicated.
 2. Provide products listed and labeled as complying with UL 467 and IEEE 837 where applicable.
- B. Conductors for Grounding and Bonding, in addition to requirements of Section 260519:
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 and IEEE 837.
 2. Unless otherwise indicated, use exothermic welded connections or irreversible compression connectors for underground, concealed and other inaccessible connections.
 - a. Exceptions:
 - 1) Direct Burial Irreversible Compression Grounding Components:
 - (a) Product: Thomas & Betts/Blackburn EZ Ground, Panduit Structured Ground Direct Burial compression grounding system or approved equal.
 - (b) System may be used for all conductor to conductor, conductor to rebar, conductor to building steel, conductor to ground rods, and conductor to grounding electrodes applications. Only specific system components and compression tools may be used.
 3. Unless otherwise indicated, use mechanical connectors, exothermic welded connections, or irreversible compression connectors for accessible connections.
 4. Manufacturers - Mechanical and Compression Connectors:
 - a. Burndy LLC;: www.burndy.com/#sle.
 - b. Harger Lightning & Grounding: www.harger.com.

- c. Thomas & Betts , a member of the ABB Group: www.tnb.com.
- d. Or Equal.
- 5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC;: www.burndy.com/#sle.
 - b. Cadweld, a brand of Erico International Corporation: www.erico.com.
 - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC;: www.thermoweld.com/#sle.
 - d. Harger Lightning & Grounding[<>]: www.harger.com.
 - e. Or Equal
- D. Ground Bars:
 - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 - 2. Telecommunications Grounding Components:
 - a. Telecommunications Primary Bonding Busbar (PBB): Chatsworth 40153 Series or equal by Panduit. Solid copper construction, .25 inches thick, 4 inches wide, 20 inches in length. Standard NEMA two hole lug pattern with stainless steel mounting brackets with insulated standoffs.
 - b. Telecommunications Secondary Bonding Busbar (SBB): Chatsworth 13622 Series or equal by Panduit. Solid copper construction, .25 inches thick, 4 inches wide, 12 inches in length. Standard NEMA two hole lug pattern with stainless steel mounting brackets with insulated standoffs.
 - c. PBB/SBB Connectors: two hole compression type connectors, copper alloy bolts and nuts.
 - 3. Size: As indicated.
 - 4. Holes for Connections: As indicated or as required for connections to be made.
- E. Ground Rod Electrodes:
 - 1. Comply with NEMA GR 1.
 - 2. Material: Copper-bonded (copper-clad) steel.
 - 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
 - 4. Manufacturers:
 - a. Erico International Corporation: www.erico.com.
 - b. Galvan Industries, Inc: www.galvanelectrical.com.
 - c. Harger Lightning & Grounding: www.harger.com.
 - d. Or Equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as shown on the drawings.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify existing conditions prior to beginning work.
- E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.
- 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 below finished grade.
 2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
 3. When using irreversible compression connectors the ground rod electrode must be knurled prior to installing compression connectors.
- 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 using silicone bronze hardware, according to manufacturer's recommended torque settings.
 5. Irreversible Compression Connectors: Secure connections using manufacturer's recommended tools and dies. Irreversible compression grounding connectors must be factory filled with an oxide inhibitor and installed using a 14 ton or larger hydraulic tool, matching the manufacturer's die to the connector. Connectors must be fully crimped, allowing visible inspection of the embossed index number on the crimped connector, which should match the same index number on the die.
- E. Identify grounding and bonding system components in accordance with Section 260553.
- F. Install ground electrodes at locations indicated herein. Install additional rod electrodes as required to achieve specified resistance to ground.
1. All of the grounding electrodes identified in section 250.52 of the NEC are required to be used if they are present or available on the premises.
 2. The identified grounding electrodes include: metal underground water pipes, metal frames of the building or structure, concrete encased electrode, ground rings, rod and pipe electrodes, plate electrodes, other underground metal underground piping.
 3. Install exothermic connections in concealed locations. Install mechanical connectors in exposed locations or utilize direct burial compression grounding system as specified.
 4. Provide exothermic welding system or direct burial compression grounding components for use in making electrical grounding connections of copper to copper or copper to steel.. Exothermically welded connections or direct burial compression grounding are required on all grounding electrode conductors, all connections to building steel (connections to structural member), all grounding conductors run under the earth, connection to ground rods and in any case where grounding conductors are subject to a hostile environment.
 - a. The exothermic welding system furnished under these specifications shall meet the applicable requirements of IEEE 80, Chapter 9, Section of conductors and joints.
 - b. Molds shall be made from graphite or other material that is so designed to provide an average life of not less than 50 exothermic welds under normal conditions. Molds shall bear permanent marking, indicating the name of the manufacturer, the mold model, the type and size of welding mixture compatible with the welding process, and the size of the conductor. Instructions detailing general safety information, and welding procedures shall be provided with each mold.
 - c. The direct burial compression grounding system components shall meet the requirements of IEEE 837.
 5. Bond metallic conduit systems and equipment isolated from each other with a bonding conductor for ground continuity.
- G. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing (UFER Ground) . Bond steel together.

1. Provide connection to one or more reinforcing steel bars that are not less than 20 feet in length and 1/2 inch in diameter or 20 feet or more of bare #2/0 copper conductor. The electrodes are required to be located within or near the bottom of the footing or foundation and be encased in at least 2 inches of concrete. The reinforcing bars are required to be of bare, zinc galvanized or other electrically conductive coated steel material.
- H. Comply with NEC
1. Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
- I. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing. Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
1. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - a. Feeders and branch circuits.
 - b. Lighting circuits.
 - c. Receptacle circuits.
 - d. Single-phase motor or appliance branch circuits.
 - e. Three-phase motor or appliance branch circuits.
 - f. Flexible raceway runs.
 - g. Armored and metal-clad cable runs.
 2. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-30.
 3. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.
 4. Water Heater, Heat-Tracing, and Anti-frost Heater Circuits: Install a separate equipment grounding conductor to each electric water heater, heat-tracing assembly, and anti-frost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- J. Service Entrance Grounding: Provide a grounding grid consisting of three driven ground rods with #3/0 bare stranded copper interconnecting conductor. Exothermically weld or irreversibly compression connect cable connections and connections to ground rods. From two points on ground grid, provide ground conductor to ground bus. From ground bus, provide ground conductor to neutral of switchgear. Install grounding bars and grounding studs at distribution centers, pull boxes, motor control centers and panelboards.
- K. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as in accordance with the NEC, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.
- L. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.
- M. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- N. Bond each above ground portion of gas piping system upstream from equipment shutoff valve.
- O. Telecommunications Grounding and Bonding Infrastructure
1. Definitions:

- a. Primary Bonding Busbar (PBB): A Busbar placed in a convenient and accessible location and bonded, by means of a bonding conductor for telecommunications, to the building service equipment ground.
 - b. Secondary Bonding Busbar (SBB): A common point of connection for telecommunications system and equipment bonding to ground, located in the telecommunications room or equipment room.
 - c. Rack Bonding Busbar (RBB): Busbar mounted on rack or cabinet to connect to the PBB or SBB.
 - d. Telecommunications Bonding Backbone (TBB): A copper conductor used to connect the PBB to the SBB.
 - e. Rack Bonding Conductor (RBC): The copper bonding conductor to connect a rack to the SBB or the PBB.
2. A Primary Busbar (PBB) shall be provided near the service entrance as indicated on the Drawings. A Telecommunications Bonding Backbone (TBB) conductor shall be provided by the Electrical Contractor from the main service entrance ground bar to the PBB. The minimum size of the TBB shall be #6 AWG or as indicated on the Drawings. Other connections to the PBB shall include:
 - a. Telecommunications surge protectors.
 - b. Cable trays and ladder racks.
 - c. Equipment racks.
 - d. Metallic communications cabling sheaths.
 - e. Metallic entrance conduits.
 - f. Telephone/data service entrance equipment.
 3. A Secondary Bonding Busbar (SBB) shall be located in each Telecommunications Room and bonded to the PBB with a minimum #6 AWG conductor or as indicated on the Drawings.
 - a. Data Network System: Provide one #6 copper conductor from the local SBB to rack bonding busbar (RBB) in each data network system termination rack.
 4. Backbone conduits between Telecommunications Rooms: Bond each end to the local SBB or PBB.
 5. Cable Sheaths; Bond all metallic cable sheaths in multipair communications cables together at each splicing and/or terminating location to provide 100 percent metallic sheath continuity throughout the communications distribution system.
 - a. At terminal points, install a cable shield bonding connector and a screw stud connection for ground wire. Use a bonding jumper to connect the cable shield connector to an appropriate ground source.
 - b. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or the splice case grounding and bonding accessories provided by the splice case manufacturer. When an external ground connection is provided as part of splice closure, connect to an approved ground source and all other metallic components and equipment at that location.
- P. Pad Mounted Transformer Grounding System:
1. Install four ground rods, one near each corner of the transformer pad. Interconnect with bare conductor. See detail on Drawings.
 2. Bond stress cones, transformer housing and all other metal work in the transformer housing, the conduit system and the secondary neutral to the ground rod neutral.
 3. Ground conduits in the transformer enclosure using grounding bushings.
- Q. Connections
1. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 2. Exothermic-Welded (CADWELD) Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating

- improper cleaning are not acceptable.
3. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs, SLUH type as manufactured by IlSCO. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
 4. Non-contact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
 5. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
 6. Irreversible Compression-Type Connections: Use hydraulic compression tools, 14 ton minimum, to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor. Compression grounding connectors shall be factory filled with oxide inhibitors.
 7. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.03 FIELD QUALITY CONTROL

- A. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.
- B. The maximum earth resistance values shall be less than 5 ohms for the service entrance ground with the counterpoise removed and no greater for the counterpoise system when measured alone. Earth resistance testing shall be done no sooner than 180 days after occupancy and prior to 360 days. Earth resistance testing shall be done by the manufacturer of the earthing/grounding components and shall be included in the cost of materials. Add additional ground rods as required to achieve specified value.
- C. Telecommunications Bonding System: Provide two point bonding measurement using an earth grounding resistance tester configured for a continuity test. The maximum measurement between nearest available grounding electrode and PBB shall be 100 milliohms.
- D. Report: Prepare test reports of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- E. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- F. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- G. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

**SECTION 260529
HANGERS AND SUPPORTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 260533.13 - Conduit: Additional support and attachment requirements for conduits.
- D. Section 260533.16 - Boxes: Additional support and attachment requirements for boxes.
- E. Section 265100 - Lighting: Additional support and attachment requirements for interior luminaires.
- F. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 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. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2009.
- F. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2010
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 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.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 033000.

1.05 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 non-penetrating rooftop supports.
- C. 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.

1.06 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.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 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 the load to be supported with a minimum safety factor of 1.5. 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. Do not use wire, chain, perforated pipe strap, wood, or other supports not listed for the application for permanent supports unless specifically indicated or permitted.
 - 7. Steel Components: Use corrosion-resistant materials suitable for 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: See Section 055000.
- C. 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.
 - e. Or equal.

- D. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
- E. Conduit Clamps: Bolted type unless otherwise indicated.
 - 1. 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.
 - e. Or Equal.
- F. 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.
 - e. Or equal.
- G. 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.
 - d. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
 - e. Or equal.
 - 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.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 - 5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
 - 6. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.
- H. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
 - 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2-inch diameter.
 - b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
 - c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
 - d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
 - e. Outlet Boxes: 1/4-inch diameter.
 - f. Luminaires: 1/4-inch diameter.
- I. 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. Green Link, Inc: www.greenlinkengineering.com/#sle.
 - d. PHP Systems/Design: www.phpsd.com/#sle.
 - e. Or equal.
 - 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 under supported component to top of roofing.
- J. 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.
 - e. Or equal.
 2. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
 3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 5. Hollow Masonry: Use toggle bolts.
 6. Hollow Stud Walls: Use toggle bolts.
 7. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 8. Sheet Metal: Use sheet metal screws.
 9. Wood: Use wood screws.
 10. Plastic and lead anchors are not permitted.
 11. Powder-actuated fasteners are not permitted.
 12. Hammer-driven anchors and fasteners are permitted only as follows:
 - a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction.
 - b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction.
 13. 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.
 - d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
 14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

- F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Field Welding, Where Approved by Architect: See Section 055000.
- I. 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. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches in height; see Section 033000.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- J. Conduit Support and Attachment: See Section 260533.13 for additional requirements.
- K. Box Support and Attachment: See Section 260533.16 for additional requirements.
- L. Interior Luminaire Support and Attachment: See Section 265100 for additional requirements.
- M. Exterior Luminaire Support and Attachment: See Section 265600 for additional requirements.
- N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- O. Secure fasteners in accordance with manufacturer's recommended torque settings.
- P. Remove temporary supports.
- Q. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 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.
- D. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1. Size metal framing system as required for the application and structural requirements.

END OF SECTION

SECTION 260533.13 CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Flexible metal conduit (FMC).
- C. Liquidtight flexible metal conduit (LFMC).
- D. Galvanized steel electrical metallic tubing (EMT).
- E. Rigid polyvinyl chloride (PVC) conduit.
- F. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260519 - Low Voltage Wiring.
- C. Section 260526 - Grounding and Bonding.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 260529 - Hangers and Supports.
- E. Section 260533.16 - Boxes.
- F. Section 260553 - Electrical Identification: Identification products and requirements.
- G. Section 26 05 80 - Excavation and Trenching.
- H. Section 262100 - Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ASTM D1598 - Standard Test Methods for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure; 2021.
- D. ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings; 2018.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
- G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
- H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
- O. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

- Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- R. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- S. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

- A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.08 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70 or as indicated on Drawings, whichever is larger.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use rigid PVC conduit.

3. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from underground.
 4. Where steel conduit is installed in direct contact with earth, use corrosion protection tape to provide supplementary corrosion protection.
- D. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).
 - E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
 - F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).
 - G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC).
 - H. Exposed, Interior, use electrical metallic tubing (EMT).
 - I. Exposed, Exterior: Use galvanized steel rigid metal conduit.
 - J. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
 1. Maximum Length: 6 feet.
 - K. Flexible Connections to Vibrating Equipment:
 1. Dry Locations: Use flexible metal conduit (FMC).
 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
 3. Maximum Length: 6 feet unless otherwise indicated.
 4. Vibrating equipment includes, but is not limited to:
 - a. Motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Electrical Service Conduits: See Section 262100 for additional requirements.
- C. Communications Systems Conduits: Also comply with Section 27 10 05.
- D. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.
- E. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- F. Provide products listed, classified, and labeled as suitable for purpose intended.
- G. Minimum Conduit Size, Unless Otherwise Indicated:
 1. Branch Circuits: 1/2-inch trade size.
 2. Branch Circuit Homeruns: 3/4-inch trade size.
 3. Control Circuits: 1/2-inch trade size.
 4. Flexible Connections to Luminaires: 3/8-inch trade size.
 5. Underground, Interior: 3/4-inch trade size.
 6. Underground, Exterior: 1-inch trade size.
- H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 5. Or Equal.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.

- b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - c. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - e. Or Equal.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc: www.afcweb.com.
 2. Electri-Flex Company: www.electriflex.com.
 3. International Metal Hose: www.metalhose.com.
 4. Or Equal.
- B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- C. Fittings:
 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. Or Equal.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
- D. Description: Interlocked steel construction.
- E. Fittings: NEMA FB 1.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc: www.afcweb.com.
 2. Electri-Flex Company: www.electriflex.com.
 3. International Metal Hose: www.metalhose.com.
 4. Or Equal.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. Or Equal.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
- D. Description: Interlocked steel construction with PVC jacket.

- E. Fittings: NEMA FB 1. Rain tight compression ring steel fitting. Connectors with insulated throat.

2.06 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedeg.com.
 - 2. Nucor Tubular Products: www.nucortubular/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube Company: www.wheatland.com.
 - 5. Or Equal.
- B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Factory-Painted, Color-Coded Galvanized Steel EMT: Apply according to indicated color code.
 - 1. See Section 260553 for color code.
- D. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 4. Connectors and Couplings: Use compression/gland or set-screw type. Insulated Throat.
 - a. Do not use indenter type connectors and couplings.
 - 5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
 - 6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
 - 1. ABB; Carlon: www.carlon.com/#sle.
 - 2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 3. Cantex Inc: www.cantexinc.com/#sle.
 - 4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.
 - 5. JM Eagle: www.jmeagle.com/#sle.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.08 COMMUNICATIONS SYSTEM CONDUITS

- A. The Electrical Contractor shall provide a complete communication raceway system as shown on drawings and in accordance with the requirements described herein.
- B. Conduit color shall be as specified in Section 26 05 53 Electrical Identification.
- C. Minimum conduit size shall be 3/4 inch or as indicated on the drawings. Conduit runs for communications systems shall be run in the most direct path, with the minimum amount of

bends possible.

- D. Install conduit from outlet to a location adjacent to the cable tray above the nearest accessible ceiling.
- E. All conduit runs shall be provided with insulated bushings and a pull wire indicating the location of the opposite end.
- F. Install conduits with the following minimum clearances:
 - 1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
 - 2. 12 inches from power conduits and cables and panelboards.
 - 3. 5 inches from fluorescent and high frequency lighting fixtures.
 - 4. 6 inches from flues, hot water pipes, and steam pipes.
- G. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
 - 1. Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
 - 2. Treat conduit in crawl spaces and under floor slabs as if exposed to view.
 - 3. Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.
 - 4. Under floor slabs, locate conduit at 12 inches, minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.
- H. Conduit bends shall be smooth, even, and free of kinks or other discontinuities that may have detrimental effects on pulling tension or cable integrity. Observe the following bend radii guidelines:
 - 1. For conduits with 2" or less internal diameter, the bend radius shall be at least 6 times the internal diameter.
 - 2. For conduits with greater than 2" internal diameter, the bend radius shall be at least 10 times the internal diameter.
- I. Conduit Fittings:
 - 1. Provide conduit fittings that maintain the bend radius requirements of the cables within. Utilize products similar to Madison Electric Products, Smart LB conduit bodies to meet the bend radius requirements for fiber optic and other communications cables.
- J. Pullboxes shall be installed in a convenient and accessible location and shall be shown on the Contractor's record drawings. Pull boxes shall be supported independently of the associated conduits. Size pullboxes per the NEC. Pullboxes for communications conduits shall be placed in sections of conduit that:
 - 1. Are 100 feet or more in length.
 - 2. Contain more than two 90 degree bends: Provide pullbox between sections with two bends or less.
 - 3. Contain reverse bends (between 100 and 180 degrees): Insert a pull point or pull box at each bend having an angle from 100 degrees to 180 degrees.
- K. A third bend in a conduit is acceptable in a pull section if the conduit capacity is derated by 15% or if one of the following is true:
 - 1. The total run is not longer than 33 feet.
 - 2. The conduit size is increased to the next trade size.
 - 3. One of the bends is within 12 inches of the cable feed end where cable is pushed around the first bend.
- L. Vertical riser conduits and sleeves shall terminate not less than 3 inches above and below the floor that the penetrate. Riser conduits and sleeves shall be reamed and bushed.
- M. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

- N. Service entrance conduits and outside plant conduits shall be cut and installed as flush to the wall as possible and extend a minimum of 4 inches above the finished floor. Provide with a pull rope rated at a minimum of 200 lbs.
- O. Underground Service Entrance: Install conduit at least 18 inches below finish grade; encase in at least 3 inches thick concrete for at least 60 inches out from the building line.
- P. All empty conduits located in communication closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

2.09 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.
- E. Foam Conduit Sealant:
 - 1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 - 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 - 3. Rated to hold minimum of 10 ft water head pressure.
 - 4. Products:
 - a. American Polywater Corporation; Polywater AFT Foam Duct Sealant: www.polywater.com/#sle.
 - b. American Polywater Corporation; Polywater FST Foam Duct Sealant: www.polywater.com/#sle.
 - c. Or Equal.
- F. Conduit Mechanical Seals:
 - 1. Listed as complying with UL 514B.
 - 2. Description: Modular sealing element unit, designed for field assembly to fill annular space between conduit and sleeve.
 - 3. Use for sealing around conduit penetrations that enter the building below grade.
 - 4. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 - 5. Suitable for sealing around conductors/cables to be installed.
 - 6. Entire conduit penetration, interior and exterior to be sealed.
 - 7. Products:
 - a. American Polywater Corporation; PHRD SG Mechanical Seals: www.polywater-haufftechnik.com/#sle.
 - b. Calpico, Inc.
 - c. Link Seal
 - d. Metraflex Co.
 - e. Or Equal.
- G. Sealing Systems for Concrete Penetrations:
 - 1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
 - 2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
 - 3. Products:
 - a. American Polywater Corporation; PZVR Cement-Coated Concrete Wall Sleeves: www.polywater-haufftechnik.com/#sle.

- b. American Polywater Corporation; PHSD Mechanical Seals: www.polywater-haufftechnik.com/#sle.
 - c. American Polywater Corporation; PHSI 150 Varia Double Wall Inserts: www.polywater-haufftechnik.com/#sle.
 - d. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.
 - e. Or Equal.
- H. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- 1. Products:
 - a. Alta Products, LLC; Sigrist Pipe Chase Housing, Curbs, and Exit Seals: www.altaproductsllc.com/#sle.
 - b. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
 - c. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.
 - d. Or Equal.
- I. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- 1. Products:
 - a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.
 - b. Or Equal.
- J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- 1. Products:
 - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.
 - b. Or Equal.

2.10 FIRESTOP

- A. Provide a firestop system with an "F" rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
- 1. For penetrations by non-combustible items including steel pipe, copper pipe, rigid steel conduit, and electrical metallic tubing (EMT), the following are acceptable:
 - a. Hilti FS 601 electrometric firestop sealant or Fs 605 HP firestop sealant.
 - b. 3M fire barrier CP25.
 - c. Nelson CLK firestop sealant
 - 2. For fire-rated construction joints and other gaps, the following may be used:
 - a. Hilti FS 601.
 - b. 3M fire barrier CP25.
 - c. Nelson CLK firestop sealant.
 - 3. All penetrations through fire barrier walls or floors shall consist of a conduit sleeve and shall be sealed with an industry approved fire barrier caulk or compound reamed and bushed. All vertical/horizontal sleeves shall be sized according to station count passing through each. Sized for maximum 60 percent fill.
 - 4. For penetrations by non-combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable, or cable bundles, and plastic pipe (closed piping systems), the following are acceptable:
 - a. Hilti FS 611A intumescent firestop sealant.
 - b. 3M barrier CP 25.
 - c. 3M fire barrier FS-195 wrap strip.

- d. Nelson FSP firestop putty, PCS pipe choke system.
- 5. For large complex penetrations made to accommodate multiple steel and copper pipes, electrical busways or raceways, the following are acceptable:
 - a. Hilti FS 635, trowelable firestop compound.
 - b. 3M fire barrier CS-195 composite sheet.
 - c. Nelson CPS composite sheet, CMP firestop compound.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify routing and termination locations of conduit prior to rough-in.
- E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.
- D. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.
- E. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 - 5. Unless otherwise approved, do not route exposed conduits:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - e. In any finished areas.
 - 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
 - 9. Arrange conduit to provide no more than 150 feet between pull points.
 - 10. Route conduits above water and drain piping where possible.
 - 11. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 - 12. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.

13. Group parallel conduits in same area on common rack.
- F. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
 8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
 9. Use of spring steel conduit clips for support of conduits is not permitted.
 - a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
 10. Use of wire for support of conduits is not permitted.
 11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound such as Thomas & Betts Kopr-Shield on field-cut threads of galvanized steel conduits prior to making connections per NEC article 300.6.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
 7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
 8. Secure joints and connections to provide mechanical strength and electrical continuity.
- H. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations

are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
 9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.
- I. Underground Installation:
1. Provide trenching and backfilling; see Section 26 05 80.
 2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 3. Provide underground warning tape in accordance with Section 260553 along entire conduit length.
 4. Where empty spare PVC conduits are installed provide a tracer wire in the conduit.
- J. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where conduits are subject to earth movement by settlement or frost.
- K. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.
 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- L. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- M. Provide grounding and bonding; see Section 260526.
- N. Identify conduits; see Section 260553.

3.03 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.
- B. All conduit in finished areas shall be installed concealed in walls, floors or ceilings unless noted otherwise on the drawings. Unfinished areas are considered mechanical rooms, electrical

rooms and utility spaces only.

- C. Route exposed conduit parallel and perpendicular to walls.
- D. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- E. Route conduit continuous from outlet to outlet, outlet to cabinets, outlet to pull or junction boxes. Secure conduit to all boxes with locknuts and bushings in such manner that each system is mechanically and electrically continuous throughout.
- F. Install all conduit within the building except where specifically noted or shown otherwise on the drawings.
- G. Conduit systems must be installed complete before conductors are pulled in.
- H. Repair any damage done to insulation or interior vapor barrier.
- I. Fill conduits which can admit air to or release air from air plenums through the connecting conduit system with sealing compound.
- J. Seal around all conduits passing through partitions such as walls, floor slabs and other elements. For non-rated partitions, sealant to match surrounding surface. For rated partitions, provide fireproofing sealant which preserves the fire resistant rating of the partition. Use materials and methods as directed by the manufacturer of the fireproofing and approved by the Architect/Engineer. See Architectural drawings and existing building drawings for location of new and existing fire-rated partitions.
- K. Install mechanical sleeve seals around all conduits that enter the building below grade. Fill the interior, around the conductors, of underground conduits that enter building with sealing compound to provide a watertight installation.
- L. Connect recessed lighting fixtures to conduit runs with a maximum of 6 feet of flexible metal conduit extending from a junction box to the fixture.

END OF SECTION

SECTION 260533.16 BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Boxes and enclosures for integrated power, data, and audio/video.
- D. Floor boxes.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping
- B. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- C. Section 260526 - Grounding and Bonding.
- D. Section 260529 - Hangers and Supports.
- E. Section 260533.13 - Conduit:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- F. Section 260553 - Electrical Identification: Identification products and requirements.
- G. Section 262726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Additional requirements for locating boxes for wiring devices.
- H. Section 27 10 05 - Telecommunications Cabling: Additional requirements for communications systems outlet boxes.

1.03 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 FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).
- 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 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- I. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 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.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for underground handhole enclosures, underground handhole enclosures, and underground handhole enclosures.
- C. Project Record Documents: Record actual locations for underground handhole enclosures, underground handhole enclosures, underground handhole enclosures, underground handhole enclosures, and underground handhole enclosures.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 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, 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 cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit is used.
 4. Use suitable concrete type boxes where flush-mounted in concrete.
 5. Use suitable masonry type boxes where flush-mounted in masonry walls.
 6. Use raised covers suitable for the type of wall construction and device configuration where required.
 7. Use shallow boxes where required by the type of wall construction.

8. Do not use "through-wall" boxes designed for access from both sides of wall.
 9. Use stamped steel bridges to fasten flush mounting outlet box between studs.
 10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 12. 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.
 13. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 14. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Communications Systems Outlets in sheetrock walls or in ceiling applications: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size. See section 27 1005 for further requirements.
 15. Use stamped steel bridges to fasten flush mounting outlet box between studs.
 16. Communications Systems Outlets installed in masonry walls: Single gang, 3 1/2 inch deep masonry box unless otherwise noted.
 17. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
 18. Wall Plates: Comply with Section 262726.
 19. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com.
 - c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com.
 - d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
 - e. Thomas & Betts Corporations Member of the ABB Group: www.tnb.com.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or 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.
 - c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.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.

2.02 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.

2.03 FLOOR BOXES - RECESSED

- A. Legrand/Wiremold REvolution Series
- B. Six Gang Floor Box rated for on grade applications
- C. Brackets: Two duplex receptacles, 4 gang RJ45 bracket and brackets for A-V components as shown on the drawings.
- D. Cover: Die cast aluminum flush cover with solid lid, nickel finish.

2.04 FLOOR BOXES - RECESSED

- A. Legrand/Wiremold RFB4 series, Thomas & Betts 665 or 667 series or equal.
- B. Gangs: 4
- C. Floor Boxes: UL514A and UL514C to meet scrub water exclusion when used on tile, terrazzo, wood and carpet floors.
- D. Material: Cast metal, fully adjustable, 3 7/16 inches (87 mm) deep. Stamped steel boxes are allowed for above grade applications.
- E. Four independent wiring compartments, two for power, two for communications.
- F. Brackets: Two duplex receptacle and two, (4) gang RJ45 brackets. Provide GFCI or blank brackets as required for the installation.
- G. Brackets: Provide blank brackets for unused compartments.
- H. Covers:
 1. Flanged die-cast aluminum assembly with Brushed Aluminum finish. Lid area to be flush with finished floor, no cutouts.

PART 3 EXECUTION

3.01 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.
- D. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.02 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. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
 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.
 - b. Communications Systems Outlets: Comply with Section 271000.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
 - 10. 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.
 - 11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
 - 12. Install boxes in or on smooth courses of masonry where possible. Where masonry style doesn't provide a smooth surface provide modification of the face of the masonry to allow proper installation of devices.
- I. 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.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 - 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. 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 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 at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.

- M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 260526.
- Q. All boxes shall be installed flush in finished spaces unless noted otherwise. Unfinished spaces include mechanical, electrical and utility rooms only.
- R. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.
- S. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.
- T. Coordinate installation of outlet boxes for equipment connected under Section 262717.
- U. Set wall mounted boxes at elevations to accommodate mounting heights indicated on the drawings or specified unless noted otherwise.
- V. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
 - 1. Adjust box locations up to 10 feet if required to accommodate intended purpose.
- W. Orient boxes to accommodate wiring devices oriented as specified in Section 262726.
- X. Maintain headroom and present neat mechanical appearance.
- Y. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- Z. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- AA. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes and mechanical radiation.
- BB. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- CC. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- DD. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- EE. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- FF. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- GG. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- HH. Use adjustable steel channel fasteners for hung ceiling outlet box.
- II. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- JJ. Use surface mounted 4-inch square box with matching raised cover on exposed conduit runs.
- KK. Use 4-inch square, 1-1/2 inch deep box with round tile ring in ceiling.
- LL. Use gang box where more than one device is mounted together. Do not use sectional box. Do not use handy box.
- MM. Use gang box with plaster ring for single device outlets.
- NN. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- OO. Set floor boxes level.
- PP. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension. Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

- QQ. Surface mounted outlets are permitted only in mechanical and electrical rooms and above removable ceilings.
- RR. Boxes protruding from the finished wall will not be accepted.
- SS. Install outlets in similar rooms in the same relative location in each room.
- TT. Locate outlets to clear piping, duct work and other obstructions.
- UU. Install switch outlets within 6 inches of latch side of door except where type of construction dictates otherwise.
- VV. Mounting heights indicated on Drawings are to center line of outlet unless indicated otherwise.
- WW. Mount duplex receptacle outlets noted to be "A.C." (above counter) 3 inches above the top of the countertop backsplash. Adjust outlet mounting height to agree with required location for equipment served.
- XX. All outlet boxes noted as WP shall be flush mounted with a sheet metal box. See section 26 27 26 for covers and devices.
- YY. Surface mounted outlet boxes noted as WP (weatherproof) shall utilize a die-cast aluminum type box with gasketed cover and device. Refer to Section 26 2726 - Wiring Devices for covers and devices
- ZZ. Pull boxes and junction boxes are not indicated on Drawings except for special requirements. Install as required to facilitate pulling wire. Size as required by National Electric Code. Install above removable ceilings, electrical rooms, utility rooms or storage areas in accessible locations. Installation in finished spaces not permitted without approval of the Architect/Engineer.
- AAA. Do not mount junction boxes or pull boxes to duct work, ceiling system or other piping. Mount from structural system only. Mount independent of conduit system. Junction boxes supported only from conduit system will not be permitted.
- BBB. Insulate behind boxes mounted in exterior walls to prevent condensation in boxes.
- CCC. Provide insulated seals around boxes mounted on exterior walls where required by the state energy code.
- DDD. Mount receptacles in the equipment rooms and in other unfinished areas at 48 inches.
- EEE. Label all junction box covers with panelboard name and circuit numbers for circuits in junction box. Label all junction box covers with the type of communication system contained within; example: "Nurse Call," "Security," etc. See section 26 0553 - Electrical Identification.

3.03 ADJUSTING

- A. Adjust floor boxes flush with finish flooring material.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused box openings.

3.04 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.05 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

**SECTION 260553
ELECTRICAL IDENTIFICATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Device and Junction Box Labels
- D. Wire and cable markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.
- H. Factory pigmented conduit.

1.02 RELATED REQUIREMENTS

- A. Section 099113 - Exterior Painting.
- B. Section 099123 - Interior Painting.
- C. Section 260519 - Low Voltage Wiring: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 26 27 26 - Wiring Devices: Device and wallplate finishes
- E. Section 27 10 05 - Telecommunications Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.
- E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 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 conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- 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.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 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. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Available fault current and date calculated.
 - 4) Identify power source and circuit number. Include location.
 - 5) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 6) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 7) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Available fault current and date calculated.
 - 3) Identify power source and circuit number. Include location.
 - 4) Identify load(s) served. Include location.
 - c. Enclosed Contactors:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify load(s) and associated circuits controlled. Include location.
 - 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
 - c. For service equipment and feeders 1000 amps or greater and all associated switchboards, panels, transformers, transfer switches, etc. provide arc flash label per 26 05 73.
 - 3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
 - 4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
 - 5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

6. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
 7. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
 8. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
 - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 099123 and 099113.
 9. 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.
 - b. Panelboards
 - c. Motor Controllers
 - d. Disconnect Switches
 - e. Industrial control panels.
 10. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
 - a. Minimum Size: 3.5 by 5 inches.
 - 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) Available fault current.
 - 3) Clearing time of service overcurrent protective device(s).
 - 4) Date label applied.
- C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
 2. Identification for Communications Conductors and Cables: Comply with Section 27 10 05.
 3. 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.
 4. 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. Within boxes when more than one circuit is present.
 5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
 6. Use underground warning tape to identify direct buried cables.
- D. Identification for Raceways:
1. Use factory-painted conduits to identify systems other than normal power system for accessible conduits.
 - a. Color Code:
 - 1) Telephone, Data Network, A-V System: Orange.
 2. Provide pigmented conduit for the following systems:
 - a. Telephone, Data Network, Television, A-V Systems: Orange

3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
 4. Use underground warning tape to identify underground raceways.
- E. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 10 05.
 2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
 3. Communications Systems: Use identification label to indicate system contained within, 'Nurse Call', 'Television', etc.
 4. Use identification label to identify fire alarm system devices.
 - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
 5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
 - a. For receptacles in areas as directed by Architect, provide identification on inside surface of wallplate.
 6. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
 7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

2.02 MANUFACTURERS

- A. Brady Corporation: www.bradycorp.com.
- B. Seton Identification Products: www.seton.com/aec.
- C. HellermannTyton: www.hellermanntyton.com.
- D. Or Equal.

2.03 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
1. Provide on all Switchboards, Panelboards, MCC's, Disconnect Switches, Transfer Switches, Transformers, Motor Controllers, other control equipment.
 2. Manufacturers:
 - a. Brimar Industries, Inc: www.brimar.com/#sle.
 - b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
 - c. Seton Identification Products: www.seton.com.
 - d. Or Equal.
 3. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use stainless steel or aluminum nameplates suitable for exterior use.
 4. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 5. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 6. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 7. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Use for devices, control switches and other small controllers.
 2. Manufacturers:
 - a. Brady Corporation: www.bradyid.com.
 - b. Brother International Corporation: www.brother-usa.com/#sle.

- c. Panduit Corp: www.panduit.com/#sle.
 - d. Or Equal.
 - 3. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
 - 4. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification Nameplates:
 - 1. Minimum Size: 1 inch by 2.5 inches.
 - 2. Legend:
 - a. System designation where applicable:
 - 1) Fire Alarm System: Identify with text "FIRE ALARM".
 - b. Equipment designation or other approved description.
 - c. Other information as indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height:
 - a. System Designation: 1 inch.
 - b. Equipment Designation: 1/2 inch.
 - c. Other Information: 1/4 inch.
 - d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
 - 5. Color:
 - a. Normal Power System: White text on black background.
- D. Format for Caution and Warning Messages Printed Labels:
 - 1. Minimum Size: 2 inches by 4 inches.
 - 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.
 - 5. Color: Black text on yellow background unless otherwise indicated.
- E. Format for Receptacle Identification Labels:
 - 1. Minimum Size: 3/8 inch by 1.5 inches.
 - 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. Color: Black text on clear background.
- F. Format for Control Device Identification Labels:
 - 1. Minimum Size: 3/8 inch by 1.5 inches.
 - 2. Legend: Load controlled or other designation indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch.
 - 5. Color: Black text on clear background.
- G. Format for Fire Alarm Device Identification Labels:
 - 1. Minimum Size: 3/8 inch by 1.5 inches.
 - 2. Legend: Designation indicated and device zone or address.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 3/16 inch.
 - 5. Color: Red text on white background.

2.04 WIRE AND CABLE MARKERS

- A. Manufacturers:
 - 1. Brady Corporation: www.bradyid.com/#sle.

2. HellermannTyton: www.hellermannntyton.com/#sle.
 3. Panduit Corp: www.panduit.com/#sle.
 4. Or Equal.
- 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.
 - G. Color: Black text on white background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 1. Brady Corporation: www.bradyid.com.
 2. Brimar Industries, Inc: www.brimar.com/#sle.
 3. Seton Identification Products: www.seton.com.
 4. Presco.
 5. Or Equal
- B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- 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.

2.06 FLOOR MARKING TAPE

- A. Manufacturers:
 1. Brady Corporation: www.bradyid.com.
 2. Brimar Industries, Inc: www.brimar.com/#sle.
 3. Insite Solutions, LLC: www.stop-painting.com/#sle.
 4. Seton Identification Products: www.seton.com.
 5. Or Equal.
- B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

2.07 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.
 5. Or Equal.
- 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.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
- 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
- 3. Minimum Size: 7 by 10 inches 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.
 - a. Do not use labels designed to be completed using handwritten text.
 - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 - 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.
- B. Degrease and clean surfaces to receive nameplates and labels.

3.02 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. Conductors and Cables: Legible from the point of access.
 - 9. 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 below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. Install identification nameplates on all switchboards, panelboards, mcc's, disconnect switches, motor controllers and other equipment control panels.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.
- C. Identify underground conduits using underground warning tape. Install one tape per trench at 12 inches below finished grade.

- D. Provide self-adhesive labels on all receptacles by identifying the panel name and circuit number, example: H1-24.
- E. Provide self-adhesive labels on all junction box covers to identify the circuits contained within for all power circuits or the system contained within for all communications systems. Example: 'Panel L1, Ckt 11' or 'Paging System'.

END OF SECTION

**SECTION 260580
EXCAVATION AND TRENCHING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section includes the furnishing and installation of the following:
 - 1. Excavating.
 - 2. Trenching.
 - 3. Backfilling.
 - 4. Surface restoration.

1.02 QUALITY ASSURANCE

- A. References:
 - 1. ASTM D-698 - Test for Moisture-Density Relations of Soils (Standard Proctor).
 - 2. ANSI/IEEEC2 - National Electric Safety Code.
 - 3. ANSI/NFPA 70 - National Electric Code.
- B. Testing Laboratory Services:
 - 1. The Owner may have compaction tests taken by an independent testing laboratory. Cost will be paid by Owner unless tests indicate compaction does not meet specifications in which case costs of initial test and any retesting will be paid by the Contractor and not charged to the Owner.

1.03 PROJECT/SITE CONDITIONS

- A. The existing underground utilities locations are not shown. Determine exact locations before commencing Work. Contractor is responsible for damages incurred by his failure to locate and preserve underground utilities.
- B. Protect existing surfaces and items not included in this Work and repair any damage to original condition.
- C. Guard against movement, settlement, collapse, or other damage of existing construction and finish grade and repair any damage to original condition.

PART 2 PRODUCTS

2.01 EXCAVATED BACKFILL MATERIALS

- A. Backfill shall be free of stone, concrete and clay lumps larger than one-tenth cubic foot, roots, stumps and rubbish.
- B. Remove and dispose of unsuitable material in backfill.

2.02 GRAVEL BACKFILL MATERIALS

- A. Gravel shall be bank run, free of lumps, rubbish, roots and other objectionable material, and be low in clay or silt content.
- B. Gradation shall conform to the following:
 - 1. Percent Passing
 - a. Sieve Size by Weight
 - b. 1" 100
 - c. 3/4" 95 - 100
 - d. #4 85 - 95
 - e. #10 65 - 85
 - f. #40 20 - 55
 - g. #100 0 - 20
 - h. #200 0 - 20

2.03 BITUMINOUS

- A. Penetration grade MN BA-2, asphalt cement 120-150 to match existing.

2.04 CONCRETE

- A. Form Materials:
 - 1. Conform to ACI 301.
 - 2. Lumber: Hem-fir species; No. 2 grade.
 - 3. Steel Forms: Minimum 16 gauge thick, stiffened to support weight of concrete with minimum deflection.
 - 4. Reinforcing Steel: Grade 60 deformed, ASTM A615.
- B. Concrete Materials:
 - 1. Cement: 5-1/2 sack mix to provide 4-inch slump.
 - 2. Aggregate: 3/4-inch maximum size coarse aggregate.
 - 3. Water: Clean and not detrimental to concrete.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify location of existing underground utilities.

3.02 PREPARATION

- A. Protect all existing underground facilities.
- B. Protect all existing above ground facilities and structures.
- C. Provide for continuance of use of all utilities.
- D. Provide for minimum of interference to vehicular and pedestrian traffic and provide suitable temporary measures to accommodate public and private traffic.
- E. Provide barricades for excavated areas.

3.03 TRENCHING

- A. Cut existing asphalt, concrete, and sod surfaces to expose area for trenching.
- B. No classification of excavated material will be made.
- C. Excavate trench to required line and grade.
- D. Keep trench width to a minimum to allow proper compaction of bedding and backfill.
- E. Organize operations to keep time of open trench to a minimum.
- F. Excavation by blasting will not be allowed.
- G. Trench bottom shall be firm for entire length and width.
- H. Remove unstable material from trench bottom and replace with approved bedding.
- I. Remove rock, shale and hardpan to one foot below bedding elevation and replace with approved foundation material.
- J. Keep trenches free from water.
- K. Dispose of excavated material not used or suitable for use as backfill.
- L. Stabilize unstable trench walls.
- M. Protect bottom of trench from frost. Do not place structures or conduit on frozen ground.

3.04 BACKFILLING AND COMPACTING

- A. Do not start encasement backfilling until work which will be covered is completed, areas are free of foreign material, and Architect/Engineer has approved.
- B. Begin backfilling and compacting after installation of foundation, structure, conduit, bedding and initial encasement backfilling have been completed.
- C. Restore underground facilities interfered with to original condition or better.
- D. Place minimum of two feet of backfill over initial encasement before beginning compaction operations.

- E. Place backfill in 12 inch layers and compact.
- F. Compaction by flooding will not be allowed.
- G. Level depressions in finished trench. Remove and dispose of excess materials.
- H. Provide gravel backfill under all structures.
- I. Place and compact backfill to bring grades to within six inches of finish grade elevation.

3.05 SURFACE RESTORATION

- A. Provide surface restoration to match existing conditions.
- B. Bituminous Surface: Patch to match existing depth of material. Surface height shall match existing.
- C. Concrete Surface:
 - 1. Patch to match existing depth of structure. Provide forms as required.
 - 2. Reinforce with rebar, size and quantity to match existing. Use minimum #3 bars at 12 inches on center.
 - 3. Steel trowel finish the surface and tool edges.
 - 4. Cover pad after finishing and keep covered for seven days. Edge forms may be removed after two days.
 - 5. Pouring concrete when temperature is less than 50 degrees is not permitted.

3.06 FIELD QUALITY CONTROL

- A. Testing: Owner may test compaction of backfill at regular frequency at various elevations and locations.
- B. Provide equipment and personnel as required to assist in locating and uncovering test sites.

3.07 COMPACTION REQUIREMENTS

- A. The percentages listed below are required density as determined by the Standard Proctor ASTM D698-78.
 - 1. Granular Fill 95% Min.
 - 2. Backfill Final Two Feet Under Pavement, Parking, Walks, Exterior Slabs and Pads 95% Min.
 - 3. Backfill at Foundation Walls 90% Min.
 - 4. Topsoil 75% to 85% Max.

3.08 TOLERANCES

- A. Granular Fill Plus or Minus 1/2 Inch
- B. Backfill Plus or Minus 0.1 Foot
- C. Topsoil Plus or Minus 0.1 Foot

END OF SECTION

**SECTION 260583
WIRING CONNECTIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical connections to Division 22 and 23 mechanical equipment.
- B. Electrical connections to Division 8 overhead doors.
- C. Electrical connections to Division 8 power assist doors.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low Voltage Wiring.
- B. Section 260533.13 - Conduit.
- C. Section 260533.16 - Boxes.
- D. Section 262726 - Wiring Devices.
- E. Section 262816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.
- B. Sequencing:
 - 1. Install rough-in of electrical connections before installation of equipment is required.
 - 2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 COORDINATION

- A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- B. Determine connection locations and requirements.
- C. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- D. Sequence electrical connections to coordinate with start-up of equipment.
- E. Install controllers and disconnect switches in mechanical rooms in accessible locations. Coordinate installation locations with Division 22 or 23 contractor.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.
- B. Flexible Conduit: As specified in Section 260533.13.
 - 1. Provide flexible conduit connections to equipment that must be removed for repair or maintenance.
 - 2. Where moist conditions are encountered such as in dishwashing areas, provide PVC jacketed flexible conduit.
- C. Wire and Cable: As specified in Section 260519.
- D. Boxes: As specified in Section 260533.16.
 - 1. In making connections to garbage disposals, dishwashers and similar units where moist conditions are encountered, provide cast aluminum boxes with gasketed covers and watertight fittings.
- E. Boiler Emergency Stop Pushbuttons:
 - 1. Manufacturer: Safety Technology International, Inc. Model SS-2209
 - 2. Yellow Housing with 'Boiler Shutdown' custom label.
 - 3. Octagon, Red colored pushbutton, push and turn to reset function.
 - 4. 2 sets of form C contacts rated at 15 amps at 125/250 volt.
 - 5. Covers:
 - a. Interior spaces not accessible to the public: No Cover.
 - b. Interior spaces accessible to the public: Provide STI model STI-6600 Mini-Stopper II cover with Horn.
 - 6. Exterior locations: Provide STI model STI-6525 Mini-Stopper, gasketed, weather rated.
 - 7. Provide conduit spacer for surface mounted locations.
- F. Telephone conduit, outlet and wiring: As specified in Section 27 10 05 - Telecommunications Cabling.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.
- B. Verify mounting locations for controllers and disconnect switches. Coordinate with Division 22 and 23 equipment locations.
- C. Verify rough-in locations of all electrical materials in elevator pit and machine room with the elevator equipment supplier before installation.
- D. Provide necessary temporary connections to facilitate elevator testing.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered. Do not use wire having a rating less than 90 degrees C.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Review floor plan drawings and motor and equipment schedule on the plans. The floor plans indicate the location of the equipment only, the schedule calls out all connection, disconnect and controller requirements.
- K. Provide a disconnecting means within sight of all motors and equipment as required by the latest edition of the NEC.
- L. Boiler Emergency Shut Down: Provide an emergency stop pushbutton at each exit out of the boiler room mounted at 60 inches. Connect to the power circuit for each boiler to shut down boilers when button is depressed. Coordinate exact requirements with Division 23 contractor.

3.03 OVERHEAD DOOR CONNECTIONS

- A. Provide unfused disconnect switch for each door operator.
- B. Provide appropriate outlet box for each control station.
- C. Provide interconnecting conduit and wiring between devices where indicated. Include cable connection to limit switch and safety bars.
- D. Install disconnect switches, controllers, control stations, and control devices as indicated.
- E. Install key operated control station on the exterior of the building. Seal conduit after conductor installation.
- F. Flush mount control stations unless otherwise noted on the Drawings.
- G. Products installed under this section but provided by Division 8:
 - 1. Pushbuttons
 - 2. Key operated control stations.

3.04 POWER ASSIST DOOR CONNECTIONS

- A. Provide unfused disconnect switch for each door operator.
- B. Provide appropriate outlet box for each control station.
- C. Provide interconnecting conduit and wiring between operator and control devices.
- D. Install disconnect switches, controllers, control stations, and control devices as indicated.
- E. Flush mount control stations unless otherwise noted on the Drawings.
- F. Products installed under this section but provided by Division 8:
 - 1. Pushpads

END OF SECTION

**SECTION 260585
CONCRETE PADS, BASES AND DUCTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section includes the furnishing and installation of the following:
 - 1. Concrete bases.
 - 2. Nonstructural concrete equipment pads.
 - 3. Concrete foundations

1.02 RELATED SECTIONS

- A. Section 26 0534 - Conduit.
- B. Section 26 2701 - Electrical Service Entrance.

1.03 REFERENCES

- A. ACI 301 - Specifications of Structural Concrete for Buildings.
- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ACI 305R - Hot Weather Concreting.
- D. ACI 306R - Cold Weather Concreting.
- E. ACI 308 - Standard Practice for Curing Concrete.
- F. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- G. ASTM C33 - Concrete Aggregates.

1.04 QUALITY ASSURANCE

- A. Installation shall be performed by workers skilled in the trade.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Conform to ACI 301.
- B. Lumber: Hem-fir species; No. 2 grade.
- C. Steel Forms: Minimum 16 gauge thick, stiffened to support weight of concrete with minimum deflection.
- D. Tubular Forms: Round, spiraled wound laminated fiber material; inside surface treated with release agent.
- E. Reinforcing Steel: Grade 60 deformed, ASTM A615.

2.02 CONCRETE MATERIALS AND MIX DESIGN

- A. Cement: 5-1/2 sack mix to provide 4-inch slump.
- B. Water to Cement Ratio: Maximum 42 percent by weight.
- C. Total Air Content: 5-8 percent, determined in accordance with ASTM C173/C173M.
- D. Aggregate: 3/4-inch maximum size coarse aggregate.
- E. Water: Clean and not detrimental to concrete.
- F. 3000 psi, 28 day rated compressive strength for all concrete when tested in accordance with ASTM C39/ C 39 M.
- G. Follow ACI 305R when concreting during hot weather.
- H. Follow ACI 306R when concreting during cold weather.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Verify compacted subgrade is acceptable and ready to support concrete pad and imposed loads.
- B. Verify gradients and elevations of the base are correct.
- C. Place reinforcement as shown on the drawings or specified.
- D. Exterior Equipment Pads and Foundations
 - 1. See detail on Drawings for size, grounding and rebar requirements.
 - 2. Steel trowel finish the exposed surfaces of foundations.
 - 3. Steel trowel finish the surface of pads and tool pad edges.
 - 4. Plane surface of pads within 1/8 inch in 10 feet as determined by a straight edge placed
 - 5. anywhere on the pad in any direction.
 - 6. Extend foundation a minimum of 4 inches in all directions beyond the maximum dimensions of the equipment
 - 7. When finishing is completed, cover foundations and keep covered for seven days. Forms may be removed after two days.
- E. Earth cannot be used for side forms. All duct banks, pads and foundations must have forms. Remove all forming before backfilling.
- F. Do not place concrete when the base surface temperature is less than 40 degrees F or if the surface is wet or frozen.
- G. Place concrete in accordance with ACI 304R.

3.02 FIELD QUALITY CONTROL

- A. Testing to be provided by the Contractor.
- B. Utilize an independent testing agency to perform field quality control tests.
 - 1. Provide free access to the site and concrete operations to the testing firm.
 - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - 3. Tests of concrete and materials may be performed at any time to ensure conformance with the specified requirements.
 - 4. Submit test reports to the Engineer for review.

END OF SECTION

**SECTION 260943
LIGHTING CONTROL SYSTEMS**

PART 1 - GENERAL

1.01 SUMMARY

- A. Standalone lighting control devices.

1.02 RELATED SECTIONS

- A. Section 26 51 00 - Lighting.
- B. Section 26 56 00 - Exterior Lighting

1.03 REFERENCES

- A. NFPA 70 - National Electrical Code; National Fire Protection Association.
- B. NEMA - National Electrical Manufacturers Association
- C. FCC emission standards
- D. UL - Underwriters Laboratories, Inc. Listings
- E. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.
- F. UL 924 - Standard for Emergency Lighting and Power Equipment
- G. ULC - Underwriter Laboratories of Canada Listings

1.04 PERFORMANCE REQUIREMENTS

- A. Lighting Control System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. System shall conform to requirements of NFPA 70.
- C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
- D. System shall be listed under UL sections 916 and/or 508.

1.05 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: For each type of product (general device descriptions, dimensions, individual wiring details, nomenclature).
 - 1. Bill of Materials: Complete list of all parts needed to fully install selected system components.
- C. Shop Drawings:
 - 1. Floor Plans: Location, orientation, and coverage area of each sensor; groups; zones; scenes; and other specific design symbols and designations as required to define the installation, location, and configuration of all control devices.
 - 2. Point List and Data Bus Devices: Summary list of all control devices, sensors, and other devices connected to each data bus. Include remaining future device capacity of data bus.
 - 3. Wire Termination Diagrams and Schedules: Coordinate nomenclature and presentation with Drawings and block diagram. Differentiate between manufacturer-installed and field-installed wiring.
 - 4. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - 5. Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs.

- 6. Room Interconnection Diagrams: Typical per room type (detailed drawings showing device interconnectivity of devices).
- D. Example Contractor Startup/Commissioning Worksheet: Must be completed prior to factory start-up.
- E. Field quality-control reports.
- F. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
- C. Address Drawing: Reflected ceiling plan and floor plans, showing data-bus-connected devices, address for each device, and device groups. The plans shall be based on construction plans, using the same legend, symbols, and schedules.
- D. As-Built Drawings: Shop drawings upgrade to reflect installed conditions.

1.07 QUALITY ASSURANCE

- A. In high humidity or cold environments, the sensors shall be rated for condensing humidity and -40 deg F operation.
- B. All applicable products must be UL/CUL Listed or other acceptable national testing organization.
- C. Contractor shall ensure that lighting system control devices and assemblies are fully compatible and can be integrated into a system that operates as described in the lighting control notes on drawings and as described within this specification. Any incompatibilities between devices, fixtures, and system controllers shall be resolved between the Contractor and the system provider, as required to ensure proper system operation and maintainability.

1.08 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
- B. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.
- C. Comply with UL 916.

1.09 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Software: Failure of input and output to execute switching or dimming commands.
 - b. Failure of modular relays to operate under manual or software commands.
 - c. Device failure.
 - d. Damage of electronic components due to transient voltage surges.
 - 2. Warranty Periods:
 - a. Control Components: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 STANDALONE CONTROL DEVICES

- A. LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS
 - 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 2. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
- B. MANUFACTURERS
 - 1. Hubbell Building Automation, Inc: www.hubbellautomation.com
 - 2. Sensor Switch Inc: www.sensorswitch.com.
 - 3. Steniel: www.steniel.net
 - 4. Leviton: www.leviton.com
 - 5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.
- C. ALL OCCUPANCY SENSORS:
 - 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 (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
 - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
 - 3. Provide LED to visually indicate motion detection.
 - 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 an adjustable turn-off delay time interval.
 - 5. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
 - 6. Turn-Off Delay: Field adjustable.
 - 7. Sensitivity: Field adjustable.
 - 8. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
 - 9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers,
 - 10. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.
 - 11. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
- D. WALL OCCUPANCY SENSORS:
 - 1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
 - c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
 - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.

- e. 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 the delayed-off time interval.
 - f. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
 - g. Provide vandal resistant lenses for passive infrared (PIR) wall switch occupancy sensors.
2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
- E. CEILING MOUNTED OCCUPANCY SENSORS:
- 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
 - c. Provide field selectable setting for disabling LED motion detector visual indicator.
 - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - e. Finish: White unless otherwise indicated.
 - 2. Ultrasonic Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
- F. DUAL TECHNOLOGY WALL DIMMER VACANCY SENSOR:
- 1. Products:
 - a. Acuity Brands - Sensor Switch: WSX PDT Series.
 - 2. Description: Wall mounted 0-10V dimming dual technology vacancy sensor.
 - 3. Capable of detecting motion within an area of 525 SqFt.
 - 4. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
 - 5. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
- G. ROOM CONTROLLERS
- 1. Room Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features
 - a. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room or factory preprogrammed.
 - b. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
 - c. Multiple room controllers connected together in a local network must automatically or be factory preprogrammed arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
 - d. Device Status LEDs to indicate:
 - 1) Data transmission
 - 2) Device has power
 - 3) Configuration status
 - e. Quick installation features including:
 - 1) Standard junction box mounting
 - 2) Quick low voltage connections using standard RJ-45 patch cable

- f. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - 1) Turn on to 100 percent
 - 2) Turn off
 - 3) Turn on to last level
 - g. Each load be configurable to operate in the following sequences based on occupancy:
 - 1) Auto-on/Auto-off (Follow on and off)
 - 2) Manual-on/Auto-off (Follow off only)
 - h. BACnet object information shall be available for the following objects:
 - 1) Load status
 - 2) Schedule state, normal or after-hours
 - 3) Room occupancy status
 - 4) Total room lighting and plug loads watts
 - 5) Electrical current
 - 6) Total watts per controller
 - 7) Total room watts/sq ft.
 - 8) Force on/off all loads
 - i. UL 2043 plenum rated
 - j. Manual override and LED indication for each load
 - k. Zero cross circuitry for each load
 - l. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
2. On/Off/0-10V Dimming Room Controllers shall include:
- a. Dual voltage (120/277 VAC, 60 Hz) capable or 347 VAC, 60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
 - b. Built in real time current monitoring
 - c. One, two or three relays configurations
 - d. Four RJ-45 local network ports or screw terminals. Provide integral strain relief
 - e. One dimming output per relay
 - 1) 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting.
 - f. Provide (2) extra.

H. POWER PACKS FOR LOW VOLTAGE OCCUPANCY SENSORS:

- 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
- 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
- 3. Input Supply Voltage: Dual rated for 120/277 VAC.
- 4. Load Rating: As required to control the load indicated on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Engage manufacturer's representative to select devices, quantities, locations, and interconnecting cabling to achieve the control sequence specified in the lighting control schedule.
- B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of lighting control devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:

- a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
 - 2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
 - 3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Wiring:
- 1. Comply with NECA 1.
 - 2. Wiring Method: Install cables in raceways except where installed in accessible ceilings. Conceal raceway and cables except in unfinished spaces. Support cables at intervals not exceeding 30".
 - 3. Route all low voltage cables separate from line-voltage conductors.
 - 4. Conductor/Cable Coordination: Verify and coordinate quantity and configuration of line voltage conductors and/or low voltage cables needed to interconnect dimming control devices with associated lighting fixtures. Control method shall match. Note that dimming methods may require different conductor/cable configurations be used for different fixtures.
 - 5. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- D. Wall Devices:
- 1. Provide junction box in wall with conduit stubbed up above nearest accessible ceiling space.
 - 2. Where cabling is routed in inaccessible locations (above hard ceilings, within floors, within walls), provide conduit routed from device to nearest accessible ceiling space.
- E. Sensors:
- 1. Select, install, and aim sensors to achieve not less than 90 percent coverage of installed areas. Do not exceed coverage limited specified in manufacturer's written instructions.
 - 2. Adjust location of sensors to minimize activation of interior rooms from adjacent corridor activity per manufacturer's direction.
 - 3. Arrange control zones per plans and details. Individual rooms (defined by full height wall partitions or doors) shall be controlled independent of adjacent rooms. Multiple occupancy sensors in the same room or zone shall control all lighting fixtures associated with that room or zone. Rooms or zones shown with multiple branch circuits shall be provided with multiple control devices to accommodate control sequence.
 - 4. 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.
 - 5. Locate ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
 - 6. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
- F. Emergency Lighting Interface:
- 1. Install emergency relay on life safety lighting circuits indicated with automatic controls. Relay shall bypass automatic controls and illuminate life safety lighting circuit upon loss of adjacent normal branch lighting circuit source voltage. Locate in associated source electrical room within NEMA-1 enclosure.

3.02 IDENTIFICATION

- A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Division 26 Section "Electrical Identification."

- B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Division 26 Section "Electrical Identification."
- C. Identify all ceiling-mounted controls with data bus number and device address.
- D. Label each device cable within 6 inches of connection to wiring terminals/ports.

3.03 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 - 1. Test continuity of each circuit.
- B. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Activate light fixtures and verify that all fixtures are operating at 100 percent.
 - 3. Confirm correct communications wiring, initiate communications between devices and controller/gateways, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.
 - 4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Field Test Reports:
 - 1. Printed list of all points created from actual queries of all addressed control points to include ballasts, manual controls, and sensors.
 - 2. Event log verifying the performance of all devices generating event messages to include occupancy sensors, control buttons, alarm messages, and any other change of value messages.
- D. Lighting controls will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies bus controllers included and describes query results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
- F. Test and Inspection Report:
 - 1. Perform tests/inspections and submit report prior to Engineer's final punch inspection.
 - 2. Report shall consist of any developed test result data and shall, at minimum, include a copy of this "Field Quality Control" Section of the specification to illustrate Contractor acknowledgement of tests and inspections.
 - a. Contractor shall indicate successful completion by initialing individual test and inspection requirements listed above on the copy. Initialing indicates that tests and inspections were performed for specified work with a successful outcome. Work not found to be in compliance was corrected and retested/reinspected successfully or has been specifically clarified and noted above by the Contractor.
- G. Upon completion of initial programming, engage engineer, architect, and Owner while on site to confirm time and scene controls/adjustments prior to final programming. Provide 2 weeks notice. Time may be required outside of normal business hours to confirm lighting for those hours of operation.

3.04 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions and to assist Owner's personnel in making program changes. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
- B. Adjust devices and wall plates to be flush and level.
- C. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

3.05 DEMONSTRATION

- A. Training: Train owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Location: At project site.

END OF SECTION 26 0943

**SECTION 262100
ELECTRICAL SERVICE ENTRANCE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low Voltage Wiring.
- B. Section 260526 - Grounding and Bonding.
- C. Section 260529 - Hangers and Supports.
- D. Section 260533.13 - Conduit.
- E. Section 260553 - Electrical Identification: Identification products and requirements.
- F. Section 26 05 85 - Concrete Pads, Bases and Ducts.
- G. Section 262416 - Panelboards: Service entrance equipment.
- H. Section 262816.16 - Enclosed Switches: Service entrance equipment.
- I. Section 264300 - Surge Protective Devices: Service entrance surge protective devices.

1.03 DEFINITIONS

- A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
 - 1. Verify the following with Utility Company representative:
 - a. Utility Company requirements, including division of responsibility.
 - b. Exact location and details of utility point of connection.
 - c. Utility easement requirements.
 - d. Utility Company charges associated with providing service.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
 - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Contractor. **Contractor shall be responsible to pay all TRANSFORMER CHARGES and any other charges associated with providing permanent or temporary service to the site.**
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

- F. Scheduling:
 - 1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
 - 2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.
- C. Project Record Documents: Record actual locations of equipment and installed service routing.

1.07 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. IEEE C2 (National Electrical Safety Code).
 - 2. NFPA 70 (National Electrical Code).
 - 3. The requirements of the Utility Company.
 - 4. The requirements of the local authorities having jurisdiction.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). 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 products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics:
 - 1. Service Type: Underground.
 - 2. Service Voltage: 208Y/120 V, 3 phase, 60 Hz.
 - 3. Service Size: As indicated on the drawings.
- C. Utility Company:
 - 1. North Central Electric COOP
- D. Division of Responsibility:
 - 1. Pad-Mounted Utility Transformers:
 - a. Transformer Pads: Furnished and installed by Contractor per Utility Company requirements.
 - b. Transformers: Furnished and installed by Utility Company.
 - c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
 - d. Transformer Protective Bollards: Furnished and installed by Contractor per Utility Company requirements.
 - e. Primary:
 - 1) Trenching and Backfilling: Provided by Contractor.
 - 2) Conduits: Furnished and installed by Contractor.
 - 3) Conductors: Furnished and installed by Utility Company.

- f. Secondary:
 - 1) Trenching and Backfilling: Provided by Contractor.
 - 2) Conduits: Furnished and installed by Contractor.
 - 3) Conductors: Furnished and installed by Contractor (Service Point at transformer).
- 2. Terminations at Service Point: Provided by Utility Company.
- 3. Metering Provisions:
 - a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
 - b. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
 - c. Metering Transformers: Furnished and installed by Utility Company.
 - d. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
 - e. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.
- E. Products Furnished by Contractor: Comply with Utility Company requirements.

2.02 MANUFACTURERS

- A. Milbank
- B. Or Approved Equal.

2.03 COMPONENTS

- A. Meter Base: Rated 320 amperes continuous duty with the following features:
 - 1. 4 jaws.
 - 2. Non-circuit closing type.
 - 3. Lever type bypass.
 - 4. Needs to meet utility company requirements.
- B. Utility Transformer Pad:
 - 1. See Section 26 05 85 - Concrete Pads, Bases and Ducts.
 - 2. Contact Utility Company for pad requirements.
 - 3. See detail on Drawings.
- C. Cable Lugs: Provide lugs in the transformer secondary compartment, transition cabinet or CT metering cabinet, and main switchboard that are suitable for the application.
- D. Other Components: As required by utility company.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide trenching and backfilling in accordance with Section 26 05 80.

- E. Provide required protective bollards in accordance with Utility Company requirements.
- F. Provide required support and attachment components in accordance with Section 260529.
- G. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.
- H. Verify that the installation is weatherproof.
- I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.04 PROTECTION

- A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 262416 PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lighting and appliance panelboards.
- B. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding.
- B. Section 260529 - Hangers and Supports.
- C. Section 260553 - Electrical Identification: Identification products and requirements.
- D. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 67 - Panelboards; Current Edition, Including All Revisions.
- K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- L. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- M. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 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 the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.
 - 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 - 4. Include documentation of listed series ratings.
- D. Manufacturer's Installation 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.
- E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 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.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- 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 written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
 - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. Schneider Electric; Square D Products: www.schneider-electric.us.
- C. Siemens Industry, Inc: www.usa.siemens.com.
- D. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a

single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
 - 2. Listed series ratings are acceptable only where specifically indicated.
 - 3. Label equipment utilizing series ratings as required by NFPA 70.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.
 - 3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: NEMA 3R/12.
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
 - c. Provide removable end walls for NEMA Type 1 enclosures.
 - 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
 - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete

assembly including surge protective device.

- L. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Sub-feed lugs.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Aluminum or copper.
 - 3. Ground Bus Material: Aluminum or copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
 - 1. Minimum Integrated Short Circuit Rating: As indicated. Panelboard shall be fully rated as an assembly, series rating within the panelboard or with upstream devices not allowed.
 - a. 240 Volt Panelboards: 10,000 amperes rms symmetrical.
 - 2. Do not use tandem circuit breakers.
 - 3. Class A ground fault interrupter circuit breakers where scheduled.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated. NEMA PB 1, Type 1.
 - 2. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.
 - 3. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 4. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Provide compression lugs where indicated and for terminating all aluminum conductors.
 - c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

- a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
- 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
- 6. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
- 7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving fluorescent lighting.
- 8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
- 9. Do not use tandem circuit breakers.
- 10. Do not use handle ties in lieu of multi-pole circuit breakers.
- 11. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
- 12. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.05 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

2.06 MOUNTING BOARDS

- A. Grade AC fire resistant plywood, 3/4 inch thick, gray paint finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.
- J. Provide grounding and bonding in accordance with Section 260526.
 - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
 - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

- K. Install all field-installed branch devices, components, and accessories.
- L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- N. Set field-adjustable circuit breaker tripping function settings as directed.
- O. Set field-adjustable ground fault protection pickup and time delay settings as directed.
- P. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- Q. Provide filler plates to cover unused spaces in panelboards.
- R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 1. Emergency and night lighting circuits.
 2. Fire detection and alarm circuits.
 3. Communications equipment circuits.
 4. Intrusion detection and access control system circuits.
 5. Video surveillance system circuits.
- S. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces. Use the Owner's room names and numbers. Do not use the plan room numbers.
- T. Provide identification nameplate for each power distribution panelboard branch device in accordance with Section 260553, clearly and specifically indicating the loads served.
- U. Provide identification nameplate for each panelboard in accordance with Section 260553.
- V. Provide arc flash warning labels in accordance with NFPA 70.
- W. Provide floor markings to clearly indicate required working clearances where indicated or where required by the authority having jurisdiction.
- X. Ground and bond panelboard enclosure according to Section 260526.
- Y. Dress conductors within panelboard and bundle with nylon cable ties.
- Z. Tighten all lugs and bolts to manufacturer's instructions.
- AA. Provide mounting board for all surface mounted panelboards. Minimum size of 1-1/2 times the width and height of panelboard. Mount securely to wall.

3.03 FIELD QUALITY CONTROL

- A. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- B. Test GFCI circuit breakers to verify proper operation.
- C. Test shunt trips to verify proper operation.
- D. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262726 WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Receptacles.
- C. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding.
- B. Section 260537 - Boxes.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260943 - Lighting Control Systems: Lighting controls, to match accessory receptacles and wallplates specified in this section.
- E. Section 271005 - Telecommunications Cabling: Voice and data jacks.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2005).
- C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; 2002 (R2008).
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- F. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- G. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- H. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 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 the contract documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

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

- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Manufacturer's Installation 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.
- D. Operation and Maintenance Data:
 1. GFI Receptacles: Include information on status indicators and testing procedures and intervals.
- E. Project Record Documents: Record actual installed locations of wiring devices.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hubbell Incorporated: www.hubbell-wiring.com.
- B. Lutron Electronics Company, Inc: www.lutron.com.
- C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
- D. Cooper Wiring Devices: www.cooperwiringdevices.com.
- E. Approved equal.
- F. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles in all educational facilities and other occupancies as required by the latest edition of the NEC.
- E. Provide GFI protection for all receptacles installed within 6 feet of sinks.
- F. Provide GFI protection for all receptacles installed in kitchens.
- G. Provide GFI protection for all receptacles serving electric drinking fountains.
- H. Provide GFCI protection for all circuits as required by the latest edition of the NEC, NFPA 70.
- I. Unless noted otherwise, do not use combination switch/receptacle devices.

2.03 ALL WIRING DEVICES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes:
 1. Wiring Devices Installed in Finished Spaces: Gray with stainless steel wall plate unless otherwise indicated.
 2. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate unless otherwise indicated.
 3. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover unless otherwise indicated.

2.04 WALL SWITCHES

- A. All Wall Switches: 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; 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.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings. Rated 1 horsepower at 120 volts, 2 horsepower at 277 volts

2.05 RECEPTACLES

- A. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; 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.
 - 3. Automatic Plug Load Control: Ensure all receptacles installed with 'automatic off' plug load control are provided from the manufacturer with permanent marking indicating either one or both receptacles in a single gang device are automatically controlled.
- B. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 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 SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
 - 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.
 - 4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, , listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- C. GFI Receptacles:
 - 1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
 - 2. Standard GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 - 3. Weather Resistant GFI 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 SE suitable for installation in damp or wet locations.
 - 4. Tamper Resistant GFI 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 GFI 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 SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

- A. All 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.
- B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
 - C. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
 - D. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected. Red Dot model CKSUV or equal.
 - E. Provide labeling of plate with panelboard and circuit number.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- 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 floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 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.

3.03 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of wiring devices provided under this section.
 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches above finished floor.
 - b. Receptacles: 18 inches above finished floor or 6 inches above counter.
 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 3. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
 4. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 5. Provide separate outlet boxes for wiring devices connected to emergency power and normal power systems.
 6. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
 7. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 8. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
 9. Locate outlet boxes so that wall plate does not span different building finishes.
 10. Locate outlet boxes so that wall plate does not cross masonry joints.

- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- E. 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.
- F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- G. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- H. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- I. Install wall switches with OFF position down.
- J. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.
- K. 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.
- L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- M. Install identification label for wall switches in accordance with Section 260526 indicating load served when controlling loads that are not visible from the control location or multiple wall switches are installed at one location.
- N. Install identification label for all receptacles in accordance with Section 260526 indicating serving branch circuit.
- O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- P. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- Q. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.04 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 260537 to obtain mounting heights specified and indicated on drawings.

3.05 FIELD QUALITY CONTROL

- A. Inspect each wiring device for damage and defects.
- B. Operate each wall switch with circuit energized to verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.06 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

**SECTION 262790
ELECTRIC SPACE HEATING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section includes the furnishing and installation of the following:
 - 1. Electric unit heaters.
 - 2. Fan forced heaters.
 - 3. Thermostats and accessories.

1.02 REFERENCES

- A. NEMA DC 3 - Low Voltage Room Thermostats.
- B. NEMA DC 15 - Line Voltage Room Thermostats.

1.03 SUBMITTALS

- A. Submit under provisions of Section 26 0500.
- B. Product Data: Provide unit size, finish, and performance data.
- C. Submit manufacturer's installation instructions.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Section 26 0500.
- B. Operation Data: Include instructions for safe operating procedures.
- C. Maintenance Data: Include instructions for replacement parts and troubleshooting diagnostics.
- D. Include recommended cleaning methods, cleaning materials, and waxes for interior parts and exterior finishes

1.05 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on Shop Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Berko, Qmark.
- B. Ouellet

2.02 ELECTRIC HORIZONTAL DISCHARGE UNIT HEATERS

- A. Description: Electric unit heater for suspended mounting, with fan forced air distribution over electric resistance heating coils and horizontal discharge.
- B. Model: Berko HUH series or equal by Qmark
- C. Input Voltage: As indicated on Drawings.
- D. Output Rating: As indicated on Drawings.
- E. Heating Element: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.
- F. Input Fuses: Provide integral fuses for units rated more than 48 amperes full load.
- G. Provide line voltage disconnect switch for each input circuit.
- H. Fabrication: Fabricate cabinet of heavy welded steel.
- I. Provide removable panel for electrical connection and control compartment.
- J. Provide internal shroud around heating elements to assure uniform air flow and delivery temperature across heater face.
- K. Provide suitable fan blade protection using wire guard.
- L. Cabinet Finish: Manufacturer's standard finish.

- M. Thermostat: Provide remote low voltage thermostat for control of heater element.
- N. Provide low voltage control transformer.
- O. Operating Stages: One.
- P. Provide terminal blocks for power and control wiring connections.
- Q. Louver: Provide discharge louver with individually adjustable blades.

2.03 FAN FORCED HEATERS

- A. Description: Recessed wall-mounted cabinet heater with fan forced air distributed over resistance heating element.
- B. Model: Berko FRC series or equal by Qmark.
- C. Input Voltage: As indicated on Drawings.
- D. Output Rating: As indicated on Drawings.
- E. Heating Element: Nickel-chromium resistance wire enclosed in a steel sheath with aluminum fins
- F. Thermostat: Provide with line voltage integral thermostat.
- G. Disconnect Switch: Built-in, integral to unit.
- H. Fabrication: Fabricate cabinet of heavy welded steel.
- I. Provide captive-screw held panel for electrical connection and control compartment.
- J. Provide with integral thermal protection and automatic fan delay.
- K. Grill: Steel bar grill with powder coat finish selected by Architect. Bars shall be narrowly spaced.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Verify that required utilities are available, in proper location, and ready for use.
- C. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Locate each unit in position indicated.
- C. Install unit with sufficient clearance from adjacent construction, piping, ductwork, and other obstructions to allow access for service and maintenance.
- D. Support unit heaters from structure using construction details shown on Drawings.

3.03 FIELD QUALITY CONTROL

- A. Verify operation of each electric heating unit by measuring input voltage and current simultaneously for period of ten minutes of continuous operation.

3.04 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 26 0500.
- B. Demonstrate location of circuit breakers and switches serving electric heating branch circuits, and location and setting procedures for thermostats and other heating controls.

END OF SECTION

SECTION 262813 FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.

1.02 RELATED REQUIREMENTS

- A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 262818 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2012.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.
- E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.
- F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.
- G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.
- H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - a. Fusible Enclosed Switches: See Section 262818.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cooper Bussmann, a division of Cooper Industries: www.cooperindustries.com.

- B. Mersen (formerly Ferraz Shawmut): www.ep-us.mersen.com
- C. Littelfuse, Inc: www.littelfuse.com.

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
- B. Feeders:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
- C. Individual Motor Branch Circuits: Class RK1, time-delay.
- D. Primary Protection for Control Transformers: Class CC, time-delay.

2.03 FUSES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
 - 1. Class RK1, Time-Delay Fuses:
- H. Class CC Fuses: Comply with UL 248-4.
 - 1. Class CC, Time-Delay Fuses:
- I. Provide the following accessories where indicated or where required to complete installation:
 - 1. Fuseholders: Compatible with indicated fuses.
 - 2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

**SECTION 262816.16
ENCLOSED SWITCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding.
- B. Section 260529 - Hangers and Supports.
- C. Section 260553 - Electrical Identification: Identification products and requirements.
- D. Section 262813 - Fuses.
- E. Section 26 05 83 - Wiring Connections

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- H. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 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.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Project Record Documents: Record actual locations of enclosed switches.
- E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 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.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton Corporation: www.eaton.com.
- B. Schneider Electric; Square D Products: www.schneider-electric.us.
- C. Siemens Industry, Inc: www.usa.siemens.com.
- D. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 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. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- 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.
 - 2. Minimum Ratings:
 - a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
 - b. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
- G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- H. Provide with switch blade contact position that is visible when the cover is open.
- I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
 - 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

- J. Conductor Terminations: Suitable for use with the conductors to be installed.
- K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- O. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
- P. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Hubs: As required for environment type; sized to accept conduits to be installed.
 - 2. 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

3.01 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.

3.02 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 above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Identify enclosed switches in accordance with Section 260553.

- J. Provide identification label on inside door of each fused switch indicating NEMA fuse class and size installed in accordance with Section 260553.
- K. Provide floor markings to clearly indicate required working clearances where indicated or where required by the authority having jurisdiction.

3.03 FIELD QUALITY CONTROL

- A. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 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.

END OF SECTION

**SECTION 264300
SURGE PROTECTIVE DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for service entrance locations.
- B. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding.
- B. Section 262416 - Panelboards.
- C. Section 271000 - Telecommunications Cabling: Protectors for communications service entrance.

1.03 ABBREVIATIONS AND ACRONYMS

- A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.
- B. SPD: Surge Protective Device.mA

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.
- E. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.
- F. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002
- G. National Electrical Code: Article 285

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
 - 1. I-nominal rating (I-n) of 20kA.
 - 2. Type 1 Device Listing
 - 3. VPR, MCOV, I-n, and Type 1, 20kA information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCR's are posted in manufacturer's UL docs.
- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.
 2. UL 1283 (for Type 2 SPDs).
 3. SPD and performance parameters shall be posted at www.UL.com <<http://www.UL.com>> under Category Code: VZCA. Products or parameters without posting at UL.com shall not be approved.
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual connections and locations of surge protective devices.

1.07 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.

1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum ten year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
- C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Schneider Electric; Square D Brand Surgellogic Products; www.surgellogic.com. IMA Series.
- B. Factory-installed, Internally Mounted Surge Protective Devices:
 1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

- B. Unless otherwise indicated, provide factory-installed, internally-mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- E. SPD shall be UL labeled as Type 1, 20kA Inominal (verifiable at UL.com), intended for use without need for external or supplemental overcurrent controls. Every component (MOV) of every mode, shall be protected by individual fusing, and matched to within + or - 1 volt. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.
- F. SPD shall be UL labeled with 20kA Inominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
- G. Protected Modes:
 - 1. Wye Systems: L-N, L-G, N-G, L-L.
- H. UL 1449 Voltage Protection Ratings (VPRs):
 - 1. 208Y/120V System Voltage: Not more than 800 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
- I. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- J. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 1. Indoor clean, dry locations: Type 1.
 - 2. Outdoor locations: Type 3R.
- K. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
 - 1. Panelboards: See Section 262416.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

- A. Surge Protective Device:
 - 1. Protection Circuits: Field-replaceable modular.
 - 2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
 - 3. Repetitive Surge Current Capacity: Not less than 5,000 impulses.
 - 4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 - 5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
 - 6. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

2.04 SURGE PROTECTIVE DEVICES BRANCH PANELBOARD LOCATIONS

- A. Surge Protective Device:
 - 1. Protection Circuits: Field-replaceable modular or non-modular.
 - 2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
 - 3. Repetitive Surge Current Capacity: Not less than 2,000 impulses.
 - 4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 - 5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
7. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
8. Emergency systems are as defined in articles 517, 700 and 701 of NFPA 70.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 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 in accordance with manufacturer's instructions and NFPA 70.
- D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.
- E. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.03 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

**SECTION 265100
LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. LED Drivers
- E. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 260537 - Boxes.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 09 23 - Lighting Control System
- D. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.
- E. Section 265600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices, Current Edition.
- B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (R2008).
- C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- D. IES LM-63 - IESNA Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- E. IES LM-79 - Approved Method: Electrical and Photometric Measurement of Solid-State Lighting Products; 2008.
- F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules, 2015.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
- I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.
- J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.
- K. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2012.
- M. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- N. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- O. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

- P. UL 1598C - Light Emitting Diode (LED) Retrofit Luminaire Conversion Kits, Current Edition, Including All Revisions.

1.04 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 the contract documents to obtain direction prior to proceeding with work.

1.05 SYSTEM DESCRIPTION

- A. Catalog numbers indicated in the Luminaire Schedule are a design series reference and do not necessarily represent the exact catalog number, size, voltage, wattage, type of light bar, driver, finish trim, ceiling type, mounting hardware or special requirements as specified or as required by the particular installations. Provide complete luminaire to correspond with the features, accessories, number of LEDs, wattage and/or size specified in the text description of each luminaire type. Additional features, accessories and options specified shall be included.
- B. Provide all frames, supplementary support structures, hangers, spacers, stems, aligner canopies, auxiliary junction boxes and other hardware as required for a complete and proper installation. Recessed luminaires shall have frames that are compatible with the ceiling systems.
- C. Luminaire voltage shall match the voltage of the circuit serving same.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. 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.
- D. Manufacturer's Installation 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.
- E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. LED fixtures shall comply with the following:
1. UL Standard 8750 "Light Emitting Diode Equipment for Use in Lighting Products", IES Standard LM-79 "Electrical and Photometric Measurements of Solid-State Lighting Products", IES Standard LM-80 "Measuring Lumen Maintenance of LED Light Sources", and IES Standard TM-21 "Projecting Long Term Lumen Maintenance of LED Light

Sources”.

- C. Conform to requirements of NFPA 70 and the International Building Code (IBC), locally adopted version.

1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- C. Store product in a clean, dry space, protected from weather.

1.09 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year pro-rata warranty for batteries for emergency lighting units.
- C. Provide ten year pro-rata warranty for batteries for self-powered exit signs.
- D. Provide a five year full warranty on all LED light fixtures including the driver.
- E. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 016000 - Product Requirements.

2.02 LUMINAIRES

- A. Provide products that are listed and labeled as complying with UL 1598.
- B. Provide products that comply with requirements of NFPA 70 and NFPA 101.
- C. Luminaires provided shall have means of disconnection from power source during service, as required in NEC Article 410.
- D. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- E. Unless otherwise indicated, provide complete luminaires including LEDs and all drivers reflectors, lenses, housings and other components required to position, energize and protect the LEDs 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. Lenses, Covers, and Diffusers:
 - 1. Acrylic Lighting Diffusers: UV stabilized high resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. Lenses shall have uniform brightness throughout the entire visible area without LED pixelation.
- I. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
 2. Fixtures installed in "hard" ceilings shall have all connections accessible through the luminaire.
- J. LED Luminaires: Listed and labeled as complying with UL 8750.
1. Luminaires:
 - a. Photometric measurements indicated on the product data shall be provided in accordance with IESNA LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting products and shall meet the requirements specified and/or indicated on the drawings.
 - b. Lumen data indicated on the product data sheets shall be generated in accordance with IESNA LM-80-08 Approved Method for Measuring Lumen Maintenance of LED Light Sources and shall meet the requirements specified and/or indicated on the drawings.
 - c. Lumen depreciation shall be identified in terms of IES TM-21-11. Unless noted otherwise, luminaires shall provide a minimum L70 rating at the drive current provided product data shall indicate such.
 - d. Correlated color temperature (CCT) indicated on the product data sheets shall be provided in accordance with ANSI C78.377-2008 American National Standard for Electric Lamps requirements specified and/or indicated on the drawings.
 - 1) LED color temperatures: CRI> 85, 2700K as noted +/- 145K.
 - 2) LED color temperatures: CRI> 85, 4000K as noted +/- 275K.
 - 3) LED color temperatures: CRI> 85, 5000K as noted +/- 283K.
 - e. Lumen output specified shall be lumens delivered from the luminaire at the color temperature specified. LED luminaires shall deliver a minimum of 60 lumens per watt. LED's shall be "Bin No. 1" quality.
 - f. Luminaires efficacy shall meet that specified and scheduled at the CCT specified.
 - g. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
 - h. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
 - i. Luminaires shall have internal thermal protection.
 - j. LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.
 - k. Color spatial uniformity shall be within .004 of CIE 1976 diagram.
 - l. Color maintenance over rated life shall be within .007 of CIE 1976.
 - m. Indoor luminaires shall have a minimum CRI of 85.
 - n. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
 - o. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management
 - p. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.
 - q. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.
 - r. The fixture shall have an integral thermal management system with extruded aluminum radiation fins and lateral airways for passive cooling, no devices using moving part are permitted.
- K. Drivers and Power Supplies:
1. Power Factor: 0.90 or higher
 2. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
 3. Output operating frequency: 60Hz.

4. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays, or Systems". LED drivers shall have a sound
 5. rating of "A", have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.
 6. Dimmable LED drivers shall be 0-10V type unless otherwise indicated. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.
 7. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
 8. Total Harmonic Distortion Rating: 20% Maximum.
 9. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
 10. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
 11. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
 12. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.
 13. Drivers shall be universal voltage (120-277 volt) or shall be 208 volt, 240 volt, or 480 volt to meet project conditions.
 14. Drivers shall be provided with protection against transients line surge.
 15. Drivers shall be equipped with a quick disconnect.
 16. Ambient temperature range shall be -30 degrees F to 104 degrees F.
 17. All drivers shall be UL listed.
- L. Controller and Control:
1. System electronics driver / controller to use coordinated communication protocols: DMX512, 0-10V, DALI, or proprietary as required
 2. The Contractor to ensure that external control equipment is compatible with LED control requirements.
 3. Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.
 4. For control components that are part of overall area control system see Lighting Controls Specifications.
 5. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers.
- M. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
 1. Sealed maintenance-free nickel cadmium unless otherwise indicated.
 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

- F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101; provide indicator light(s) to report test and diagnostic status.
- G. Accessories:
 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
 2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
 3. Provide compatible accessory wire guards where indicated.
 4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 EXIT SIGNS

- A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
 1. Number of Faces: Single or double as indicated or as required for the installed location.
 2. Directional Arrows: As indicated or as required for the installed location.
- B. Self-Powered Exit Signs:
 1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
 3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
 5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- C. Accessories:
 1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
 2. Provide compatible accessory wire guards where indicated.

2.05 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- 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.

3.02 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.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. 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 pendant-mounted luminaires to building structure.
 - 4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- F. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
- G. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports. Utilize 1/2 inch rigid conduit stems unless noted as chain or cable suspended on the drawings.
 - 4. Install canopies tight to mounting surface.
 - 5. Unless otherwise indicated, support pendants from swivel hangers.
- H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- I. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 and 502.
- J. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- K. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.
- L. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- M. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- N. Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- O. Install recessed luminaires to permit removal from below.
- P. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating. Provide all necessary components to maintain ceiling system fire rating, coordinate with ceiling installer.
- Q. Install clips to secure recessed grid-supported luminaires in place.
- R. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings. Coordinate exact mounting heights with Architectural Drawings.

- S. Install accessories furnished with each luminaire.
- T. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture; use flexible conduit.
- U. Connect luminaires and exit signs to branch circuit outlets provided under Section 260537 using flexible conduit.
- V. Bond products and metal accessories to branch circuit equipment grounding conductor.
- W. Attach all surface mounted fixtures to ceiling or wall surface with a minimum of two attachment points besides the outlet box.
- X. Install recessed plaster frames, or other special frames where required for construction type. Install frames securely to provide adequate light fixture support.
- Y. Insure that luminaires requiring access to ballasts or junction boxes have adequate openings and clearances.
- Z. Maintain required clearances between insulation and light fixtures where light fixtures are installed in an insulated ceiling. Provide barriers as needed to prevent insulation from contacting light fixture.
- AA. Pendant mounted luminaires shall utilize factory stems with suitable canopy unless noted as "chain suspended" or "cable suspended." For sloped ceilings, provide a swivel type canopy. Install individually mounted pendant fixtures with one stem at each end of fixture.
- BB. For chain suspended and cable suspended light fixtures, use flexible metal conduit and attach to light fixture support chain or cable.
- CC. Provide adequate backing and support from the structural system for all pendent supported fixtures.
- DD. Coordinate light fixture installation in unfinished areas with piping, duct work and other obstructions. Exact light fixture location to be determined by field conditions. Suspend light fixture with chains or stems if necessary to avoid mounting light fixtures above ceiling mounted equipment, duct work and piping. Use trapeze style hangers to mount light fixtures under duct work piping or other equipment.
- EE. All circuiting for emergency egress lights and exit lighting will be in separate conduits from all other circuiting.
- FF. Emergency Lighting Units:
 - 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.
- GG. 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.

3.04 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.
- E. Examine drawings and site conditions for ceiling construction, structural depths, piping and ductwork locations, door heights, upper cabinet heights and location, and other building elements. Coordinate to avoid conflict with luminaire installation.

- F. A visual inspection shall be performed to verify cleanliness and alignment of the fixtures. Misalignment and light leaks shall be corrected, and rattles due to ventilation system vibration shall be eliminated.
- G. Perform an operational test to verify that all fixtures illuminate properly, dimming systems dim properly (i.e. no flicker), and lighting zones are switched according to the drawings.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. 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.
- D. Aim and adjust fixtures as directed.
- E. Position exit sign directional arrows as indicated.

3.06 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.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

3.09 SCHEDULE - SEE DRAWINGS

END OF SECTION

**SECTION 265600
EXTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260537 - Boxes.
- C. Section 265100 - Interior Lighting.

1.03 REFERENCE STANDARDS

- A. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- B. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000(R2005) (ANSI/IES RP8).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- D. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- E. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2006.
- F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- H. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. 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, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
 - 1. LEDs: Include rated life and initial and mean lumen output.
 - 2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
- D. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- G. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- C. Store product in a clean, dry space, protected from weather.

1.08 WARRANTY

- A. Provide a five year full warranty on all LED light fixtures including the driver.
- B. Provide a two year full warranty on pole and finishes.

1.09 COORDINATION

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the Drawings.
- B. Substitutions: See Section 016000 - Product Requirements.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598.
- C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- D. Optical Assemblies: Where specified, full cutoff with zero uplight, "Dark Sky" compliant. LED assemblies shall comply with IESNA BUG rating system.
- E. Unless otherwise indicated, provide complete luminaires including LEDs and all drivers reflectors, lenses, housings and other components required to position, energize and protect the LEDs and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, 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. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- I. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
- J. Wall Mounted Luminaires:

1. Refer to architectural elevations for mounting heights.
- K. LED Luminaires: Listed and labeled as complying with UL 8750.
 1. Luminaires:
 - a. Photometric measurements indicated on the product data shall be provided in accordance with IESNA LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting products and shall meet the requirements specified and/or indicated on the drawings.
 - b. Lumen data indicated on the product data sheets shall be generated in accordance with IESNA LM-80-08 Approved Method for Measuring Lumen Maintenance of LED Light Sources and shall meet the requirements specified and/or indicated on the drawings.
 - c. Lumen depreciation shall be identified in terms of IES TM-21-11. Unless noted otherwise, luminaires shall provide a minimum L70 rating at the drive current provided product data shall indicate such.
 - d. Lumen output specified shall be lumens delivered from the luminaire at the color temperature specified. LED luminaires shall deliver a minimum of 80 lumens per watt.
 - e. Luminaires efficacy shall meet that specified and scheduled at the CCT specified.
 - f. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
 - g. Luminaires shall have internal thermal protection.
 - h. The housing shall have an integral thermal management system with extruded aluminum radiation fins and lateral airways for passive cooling, no devices using moving part are permitted.
- L. Exposed Hardware: Stainless steel.

2.03 DRIVERS

- A. Power Factor: 0.90 or higher
- B. Output operating frequency: 60Hz.
- C. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays, or Systems". LED drivers shall have a sound
- D. rating of "A", have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.
- E. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
- F. Total Harmonic Distortion Rating: 20% Maximum.
- G. Meet electrical and thermal conditions as described in LM-80 Section 5.0.
- H. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
- I. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.
- J. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.
- K. Drivers shall be universal voltage (120-277 volt) or shall be 208 volt, 240 volt, or 480 volt to meet project conditions.
- L. Drivers shall be provided with protection against transients line surge.
- M. Drivers shall be equipped with a quick disconnect.
- N. Ambient temperature range shall be -30 degrees F to 104 degrees F.
- O. All drivers shall be UL listed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- 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.

3.02 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.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA/IESNA 501 (exterior lighting).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
- F. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire. Refer to architectural elevations for mounting heights.
- G. Install accessories furnished with each luminaire.
- H. Bond products and metal accessories to branch circuit equipment grounding conductor.
- I. Install one spare 1-1/4 inch conduit stubout at each end of line fixture. See plans for additional spare stubouts.
- J. Install controls indicated on Drawings.
- K. Insure that all exterior light fixtures are watertight after installation and all weep holes are open.
- L. All light fixtures installed in canopies and other exterior locations must be suitable for wet location.

3.04 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.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and adjust luminaires to provide illumination levels and distribution as directed.

3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosure.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.07 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

3.08 SCHEDULE - SEE DRAWINGS

END OF SECTION

**SECTION 271005
TELECOMMUNICATIONS CABLING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Installation of CAT 6 cables. The electrical contractor (EC) will install all CAT 6 cables from the outlets/devices/camera rough-in location to the owner-provided data rack location. The owner will furnish the CAT 6 cables to the EC for installation. The EC will provide j-hooks/supporting accessories/conduits as needed for routing the CAT 6 cables. The EC needs to coordinate and communicate with the owner for all installations and routing of CAT 6 cables. The owner will also perform all terminations and testing.
- B. Communications identification.
- C. Telecommunications service entrance to building(s).
- D. Cabling and pathways inside building(s).
- E. Grounding and bonding the telecommunications distribution system.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260526 - Grounding and Bonding.
 - 1. Includes bonding jumpers for bonding of communications systems and electrical system grounding.
- C. Section 260533.13 - Conduit.
- D. Section 260533.16 - Boxes.
- E. Section 260553 - Electrical Identification: Identification products.
- F. Section 262726 - Wiring Devices.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).
- C. TIA-492AAAD - Detail Specification for 850-nm Laser- Optimized, 50-µm Core Diameter/125-µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fiber; 2009.
- D. TIA-492AAAC-B - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.
- E. TIA-492AAAB-A - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009a.
- F. TIA-492AAAA-B - Detail Specification for 62.5-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.
- G. TIA-492CAAB - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak; 2000 (Reaffirmed 2005).
- H. TIA-492CAAA - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers; 1998 (Reaffirmed 2002).
- I. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Alliance/Electrical Components Association; Revision E, 2005.
- J. ICEA S-83-596 - Indoor Optical Fiber Cables; Insulated Cable Engineers Association; 2011 (ANSI/ICEA S-83-596).

- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. TIA-526-14 - OFSTP-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; Telecommunications Industry Association; Rev B, 2010.
- M. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2015
- N. TIA-568-C.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Telecommunications Industry Association; Rev C, 2009.
- O. TIA-568-C.3 - Optical Fiber Cabling Components Standard; Telecommunications Industry Association; 2008 (with Addenda; 2011).
- P. TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables; Rev B, 2000; Addendum 1.
- Q. TIA-569-C - Telecommunications Pathways and Spaces; Telecommunications Industry Association; Rev C, 2012 (with Addenda; 2013).
- R. TIA-598-C - Optical Fiber Cable Color Coding; Telecommunications Industry Association; Rev C, 2005.
- S. TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Telecommunications Industry Association; Rev B, 2012.
- T. TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Telecommunications Industry Association; Rev B, 2012 (with Addenda; 2013).
- U. UL 497 - Standard for Protectors for Paired-Conductor Communications Circuits; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
 - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
 - 3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Arrange for Communications Service Provider to provide service.
- C. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Communications Service Provider representative.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
 - 1. Storage and handling requirements and recommendations.
 - 2. Installation methods.
- C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
 - 1. Provide in writing as part of the Shop Drawing Submittal that the selected wiring and device Manufacturers system Warranty meets the requirements of Paragraph 1.08 Warranty.

2. Provide floorplan drawings showing suggested routing of cabling to the furthest telecommunications jack from the assigned termination rack to confirm telecommunications outlets and associated devices with telecommunications cabling connections are within rated distances of the assigned MDF/IDF Rooms. If cabling distances exceed the recommended manufacturer distances the bidder shall provide written notice to the Engineer for clarification in the shop drawing submittals.
 3. Confirm drawings show sufficient quantity and size of cable pathways and cable tray. Note any required revisions to pathway sizes or routing in the shop drawing submittal floorplan drawings.
- D. Manufacturer Qualifications.
 - E. Evidence of qualifications for installer(s).
 - F. Field Test Reports.
 - G. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
 1. Record actual locations of outlet boxes and distribution frames.
 2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
 3. Identify distribution frames and equipment rooms by room number on contract drawings.
 - H. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.
- B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
 1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
 2. Supervisors and installers factory certified by manufacturers of products to be installed.
 3. Employing experienced technicians for all work; show at least 3 years experience in the installation of the type of system specified, with evidence from at least 2 projects that have been in use for at least 18 months; submit project name, address, and written certification by user.
 4. The entire installation of the telecommunications system as specified in this section of the specifications shall be completed by an acceptable systems installer. The acceptable systems installers shall meet the following criteria.
 - a. The following installers have been reviewed for their performance and are acceptable installers for this project:
 - 1) ABT Data Technologies, Inc.
 - 2) Archkey Technologies, Inc.
 - 3) Network Cabling Services, Inc.
 - 4) Dellcomm, Inc
 - 5) RBB Electric, Inc.
 - b. All other installers requesting approval to bid this project must submit the following information for evaluation in accordance with Section 26 50 00 and the General Conditions:
 - 1) General Company Information.
 - 2) RCDD Certificate for person preparing and approving the installation. The RCDD is required to be employed by the installing contractor.
 - 3) List of projects, with description of work performed in the last five years. Project list shall include cost of communications system, Owner's representative, address and telephone number.
 - c. Final approval of acceptable installers will be at the discretion of the Architect/Engineer and the Owner.

- C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep stored products clean and dry.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 1 year period after Date of Substantial Completion.
- C. Manufacturer shall warranty and provide maintenance service for 15 years minimum on the network system and a lifetime for products used in the system.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN BY OWNER: EC RESPONSIBLE TO INSTALL ALL CAT 6 CABLES FROM OUTLET/DEVICES/CAMERA LOCATIONS TO OWNER PROVIDED DATA RACK LOCATION. CAT 6 CABLES FURNISHED BY OWNER, INSTALLED BY CONTRACTOR. ALL TELECOM EQUIPMENT BY OWNER. TELECOMMUNICATIONS GROUNDING AND BONDING PROVIDED BY EC.

- A. System Description:
 - 1. Building Entrance Cabling: By Telecom Service Provider.
 - 2. Building Entrance Conduit: 3" Schedule 40 PVC.
 - 3. Horizontal Cabling: Copper.
- B. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
 - 1. Locate main distribution frame as indicated on the drawings.
 - 2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.
- C. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 PATHWAYS

- A. Conduit: As specified in Section 260533.13; provide pull cords in all conduit.
- B. Outlets
 - 1. As specified in Section 26 05 37 - Boxes.
- C. Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40.

2.03 GROUNDING AND BONDING COMPONENTS

- A. Comply with TIA-607.
- B. Comply with Section 260526.

2.04 IDENTIFICATION PRODUCTS

- A. Comply with TIA-606.
- B. Comply with Section 260553.

2.05 SOURCE QUALITY CONTROL

- A. Factory test cables according to TIA-568.

2.06 PENETRATIONS

- A. Cable Sleeves
 - 1. For fire or smoke wall penetrations provide Hilti CP 653 Speed Sleeve or approved Equal
 - 2. Provide cable sleeves at all up to 2 hour fire rated wall penetrations.

3. Provide quantity and size (either 2 inch or 4 inch) of sleeves as required for 60% maximum fill of the quantity of cables being installed.
4. For non-fire rated partitions, provide conduit sleeves through the partitions providing quantity and size of conduits as required for 60% maximum fill of the quantity of cables being installed.

B. See Section 26 05 34 for additional requirements.

2.07 CABLE SUPPORT HANGERS

A. See Section 26 05 36 for cable tray requirements.

B. Manufacturers:

1. Panduit J-Pro Series J-hook.
2. CADDY CAT HP Series J-hook.
3. CADDY CAT 425 Series adjustable strap hanger.
4. Approved Equal.
 - a. Panduit JP2 Series j-hook shall be used for up to 46 Category 6 4-pair communications cables, 30 Category 6A cables.
 - b. Panduit JP4 Series j-hook shall be used for up to 180 Category 6 cables or 115 Category 6A cables.
 - c. Caddy CAT 425 Series adjustable cable support for up to 325 Category 6 cables, or 210 Category 6A cables.
 - d. Manufacturer guidelines shall be used for supporting/mounting the cable supports. Provide wall mount, ceiling mount, threaded rod clip, beam clamp, etc. mounting option as appropriate for the installation
 - e. Cable shall be supported at no greater than four-foot intervals for Category 6 cable. Provide a cable tie at each J-hook to retain and manage the cable bundle.
 - f. J-hooks or adjustable cable supports. to be UL listed as suitable for air handling plenum spaces.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. See Section 26 0534 Conduit for Telecommunications raceway installation requirements.
- B. See Section 26 0526 Grounding and Bonding for Electrical Systems for Telecommunications systems grounding and bonding requirements.
- C. Comply with Communication Service Provider requirements.
- D. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.
- E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

3.02 INSTALLATION OF PATHWAYS

- A. Underground Service Entrance: Install conduit at least 18 inches below finish grade; encase in at least 3 inches thick concrete for at least 60 inches out from the building line.
- B. Install pathways with the following minimum clearances:
 1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
 2. 12 inches from power conduits and cables and panelboards.
 3. 5 inches from fluorescent and high frequency lighting fixtures.
 4. 6 inches from flues, hot water pipes, and steam pipes.
- C. Conduit, in Addition to Requirements of Section 260533.13:
 1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
 2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
 3. Arrange conduit to provide no more than 100 feet between pull points.

4. Do not use conduit bodies.
- D. Conduit:
1. All penetrations through fire barrier walls or floors shall consist of a conduit sleeve and shall be sealed with an industry approved fire barrier caulk or compound reamed and bushed. All vertical/horizontal sleeves shall be sized according to station count passing through each. Sized for maximum 60 percent fill.
 2. Install conduit from outlet to a location adjacent to the cable tray above the nearest accessible ceiling. Terminate conduit using an insulated bushing.
- E. Firestopping: Seal openings around pathway penetrations through fire-rated walls, partitions, floors, and ceilings in accordance with Section 078400.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

- A. Cabling:
1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
 2. Do not over-cinch or crush cables.
 3. Do not exceed manufacturer's recommended cable pull tension.
 4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
 5. Install cable support hooks a maximum of 4'-0" on center above ceiling.
 6. Where cable tray is installed, run telecommunications cabling in cable tray.
 7. Where telecommunication cables are run exposed above accessible ceilings, support the cables to keep them from resting on ceiling tiles. Use properly sized Cable Caddies or J-Hooks on walls above the ceilings to neatly route cables between outlet and termination locations. Minimum distance between supports is 4 feet or in accordance with EAI/TIA standards, whichever is less.
- B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 120 inches.
- C. Copper Cabling:
1. Category 6 and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
 2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
 3. Bridged taps/splices are not allowed as part of the horizontal wiring system.
 4. Avoid routing cables near EMI sources.
 5. All cabling shall consist of 4 pairs and 1 cable per jack.
 6. Install modular outlets at all locations shown on the Drawings. Terminate wiring at workstation jacks and rack.
 7. Install cable from all workstation outlets to rack.
 8. Each workstation jack shall be provided with its own UTP cable continuous (without splice) from jack to rack.
 9. Telecommunications wiring shall be used for both voice and data wiring.
 10. Where indicated, workstation jacks may be ganged under a common wall plate.
- D. Identification:
1. Use wire and cable markers to identify cables at each end.
- E. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.
1. Cables: Install color coded labels on both ends.
 2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.
 3. All horizontal cabling shall be labeled with permanent tag indication from which jack the cable originated.
 4. Machine labels shall be installed on each workstation jack faceplate.

5. All labels shall be a machine label in conformance with ANSI/EIA/TIA 606.
6. Numbering of workstation jacks shall be consistent.
7. Labeling to be verified with Engineer and Owner.
8. Final room numbers to be used for labeling, room numbers on plans are not to be used.

3.04 FIELD QUALITY CONTROL

- A. Comply with inspection and testing requirements of specified installation standards.
- B. Visual Inspection:
 1. Inspect cable jackets for certification markings.
 2. Inspect cable terminations for color coded labels of proper type.
 3. Inspect outlet plates and patch panels for complete labels.

END OF SECTION

SECTION 312200
SITE GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of topsoil.
- B. Rough grading the site for site structures.
- C. Finish grading.

1.02 RELATED REQUIREMENTS

- A. Section 312323 - Fill and Backfill: Filling and compaction.

1.03 PROJECT CONDITIONS

- A. Protect above- and below-grade utilities that remain.
- B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: Topsoil excavated on-site.
 - 1. Graded.
 - 2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
- B. Other Fill Materials: See Section 312323.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the work are as indicated.
- B. Verify the absence of standing or ponding water.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage above- and below-grade utilities to remain.
- D. Notify utility company to remove and relocate utilities.
- E. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.
- F. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil , unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.

- F. See Section 312323 for filling procedures.
- G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.
- H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- I. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL

- A. Stockpile topsoil to be re-used on site; remove remainder from site.
- B. Stockpile subsoil to be re-used on site; remove remainder from site.
- C. Stockpiles: Use areas designated on site; pile depth not to exceed 15 feet; protect from erosion.

3.05 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
- C. Where topsoil is to be placed, scarify surface to depth of 6 inches.
- D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 12 inches.
- E. Place topsoil where required to level finish grade.
- F. Place topsoil to nominal depth of 6 inches.
- G. Place topsoil during dry weather.
- H. Remove roots, weeds, rocks, and foreign material while spreading.
- I. Near plants spread topsoil manually to prevent damage.
- J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- K. Lightly compact placed topsoil.
- L. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.06 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.07 REPAIR AND RESTORATION

- A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

3.08 FIELD QUALITY CONTROL

- A. See Section 014000 for compaction density testing.

3.09 CLEANING

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 312316.13

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

- A. Section 312200 - Site Grading.
- B. Section 312323 - Fill and Backfill.
- C. Section 330561 - Concrete Manholes.
- D. Section 331416 - Site Water Utility Distribution Piping.
- E. Section 333113 - Site Sanitary Sewerage Gravity Piping.
- F. Section 334213 - Stormwater Culverts.

1.03 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- C. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

1.06 DEWATERING AND BASIN DRAINING

- A. The level of the water table can be high and often fluctuates seasonally. The Contractor shall take this fact into account when preparing their bid. **All dewatering is considered incidental to the the Project.**
- B. If the Contractor intends to dewater any construction area and discharge that water to a drain or stream, they must first obtain coverage under North Dakota's General Permit to discharge from temporary dewatering activities. To obtain coverage under this permit or

for additional information, contact the North Dakota Department of Health, Environmental Health - Water Quality section at 701-328-5210. Any costs associated with the permit shall be paid for by the Contractor.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Subsoil excavated on-site.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- B. Granular Fill: Coarse Aggregate, ND Class 3, See Section 321123 - Aggregate Base Course.
- C. Topsoil: Topsoil excavated on-site.
 - 1. Graded.
 - 2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

2.02 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 TRENCHING

- A. Notify Owner's Representative of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- G. Remove excavated material that is unsuitable for re-use from site.
- H. Stockpile excavated material to be re-used in area designated in Section 312200.
- I. Remove excess excavated material from site.
- J. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Owner's Representative. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.03 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.04 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Thrust bearing surfaces: Fill with concrete.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. 95 percent of maximum dry density.
 - 2. Moisture Range: +3 / -1 of optimum moisture.
- K. Reshape and re-compact fills subjected to vehicular traffic.

3.05 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping and Conduits:
 - 1. Bedding: Use granular fill.
 - 2. Cover with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
 - 5. Moisture Range: +3 / -1 of optimum moisture.

3.06 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1/2 inch from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1/2 inch from required elevations.

3.07 FIELD QUALITY CONTROL

- A. See Section 014000 for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("standard Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no additional cost to the Owner.

3.08 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 312323
FILL AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for building volume below grade, paving, and site structures.
- B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED REQUIREMENTS

- A. Section 312200 - Site Grading.
- B. Section 312316 - Excavation: Removal and handling of soil to be re-used.
- C. Section 312316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

1.03 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- C. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- E. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.
- C. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Subsoil excavated on-site.
 - 1. Graded.

- 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
- B. Granular Fill: Coarse Aggregate, See Section 321123 - Aggregate Base Course.
- C. Topsoil: Topsoil excavated on-site.
 - 1. Graded.
 - 2. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.

2.02 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the Work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.
- C. See Section 312200 for additional requirements.
- D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- E. Verify structural ability of unsupported walls to support imposed loads by the fill.
- F. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

- A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth. Compact to 95 percent of maximum dry density.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated in accordance with geotechnical report.

1. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- J. Reshape and re-compact fills subjected to vehicular traffic.
- K. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Owner's Representative. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:
1. Bedding: Use granular fill.
 2. Cover with general fill.
 3. Fill up to subgrade elevation.
 4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
 - a. Moisture Range: +3/-3 of optimum moisture.
- C. At Lawn Areas:
1. Use general fill or topsoil.
 2. Fill up to subgrade elevations.
 3. Compact to 90 percent of maximum dry density.
 - a. Moisture Range: +3/-3 of optimum moisture.
 4. See Section 312200 for topsoil placement.
- D. Under Monolithic Paving:
1. Compact subsoil to 95 percent of its maximum dry density before placing fill.
 - a. Moisture Range: +3/-3 of optimum moisture.
 2. Use general fill.
 3. Fill up to subgrade elevation.
 4. Compact to 95 percent of maximum dry density.
 - a. Moisture Range: +3/-3 of optimum moisture.
 5. See Section 321123 for aggregate base course placed over fill.

3.05 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1/2 inch from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1/2 inch from required elevations.

3.06 FIELD QUALITY CONTROL

- A. See Section 014000 for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D1557 ("modified Proctor"), or ASTM D698 ("standard Proctor").
- D. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

3.07 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 312525

GEOTEXTILE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnish and install geotextile for use as a stabilizer and separator to prevent intermixing of subgrade soils and selected fill materials.

1.02 RELATED SECTIONS

- A. Section 312200 - Site Grading.
- B. Section 312323 - Fill and Backfill.

1.03 SUBMITTALS

- A. Submit product data, manufacturer's instructions, and manufacturer's certificates.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Rolls shall be furnished with wrapping suitable for protection against moisture and extended ultraviolet exposure.
- B. Store rolls in a manner that protects them from the elements.
- C. If outdoor storage, elevate and protect rolls with waterproof cover.
- D. Geotextile rolls shall not be exposed to sunlight for a period exceeding 14 days.
- E. Replace damaged geotextiles.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Geosynthetics for Separation, Riprap, and Reinforcement
 - 1. Geotextile shall be composed of long chain polymeric filaments (95 percent by weight, polyolefins, polyesters or polyamide) formed into a woven fabric.
- B. Geotextiles shall be free of defects or flaws.
- C. Geotextile shall meet the requirements shown below:

PROPERTY AND TEST METHOD	MINIMUM VALUE
Grab Tensile Strength (ASTM D 4632)	300lbs
Grab Elongation (ASTM D 4632)	15%
CBR Puncture Strength (ASTM D 6241)	900lbs
Trapezoid Tear (ASTM D 4533)	113lbs
Permittivity (ASTM D 4491)	0.02 - 0.05 / sec.-1
Apparent Opening Size (ASTM D 4751)	40 U.S. sieve

PART 3 EXECUTION

3.01 PREPARATION

- A. Clear installation area of all obstructions, native vegetation, roots, and other debris which may damage geotextile.

3.02 GEOTEXTILE PLACEMENT

- A. See plan details for placement.
- B. Unroll smoothly on subgrade in direction of construction traffic.
- C. Overlap in direction of subbase placement.
- D. Minimum overlap is 2 feet.
- E. Do not drag geotextile across subgrade.

F. Replace damaged geotextile with a minimum patch size of damaged area plus 3 feet.

3.03 AGGREGATE PLACEMENT

- A. Dumping on geotextile is not permitted.
- B. Traffic directly on geotextile is not permitted.
- C. Fill any ruts with additional aggregate.

END OF SECTION

SECTION 321123
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction Entrance.
- B. Aggregate Bedding
- C. Paving aggregates.

1.02 RELATED REQUIREMENTS

- A. Section 015713 - Erosion Control.
- B. Section 312200 - Site Grading: Preparation of site for base course.
- C. Section 312316.13 - Trenching: Compacted fill over utility trenches under base course.
- D. Section 312323 - Fill and Backfill: Compacted fill under base course.
- E. Section 321216 - Asphalt Paving.
- F. Section 321313 - Concrete Paving.

1.03 REFERENCE STANDARDS

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- D. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- G. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. Aggregate Storage, General:
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the work are as indicated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Coarse Aggregate Class 3: Coarse aggregate, conforming to State of ND Highway Department Class 3 standard for utility trenches.
- B. Coarse Aggregate Class 5: Coarse aggregate, conforming to State of ND Highway Department Class 5 standard under asphalt or concrete paving.
- C. Crushed Concrete aggregate, conforming to State of ND Highway Department Salvaged Base Course standard under asphalt or concrete paving.

2.02 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. Place aggregate in maximum 6 inch layers, roller compact to 100 percent of maximum dry density.
- B. Level and contour surfaces to elevations and gradients indicated.
- C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 014000 for general requirements for field inspection and testing.
- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").

- D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no additional cost to the Owner.
- E. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.06 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 321216
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Double course bituminous concrete paving.

1.02 RELATED REQUIREMENTS

- A. Section 312200 - Site Grading: Preparation of site for paving and base.
- B. Section 312323 - Fill and Backfill: Compacted subgrade for paving.
- C. Section 321123 - Aggregate Base Course: ND Class 5 aggregate base course or salvaged base course.

1.03 REFERENCE STANDARDS

- A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; 1997.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with State of ND Highways standard.
- B. Mixing Plant: Complying with State of ND Highways standard.
- C. Obtain materials from same source throughout.

1.05 FIELD CONDITIONS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: ASTM D 946, In accordance with State of ND Highways Standards, FAA 42 Mix.
- B. Aggregate for Base Course: In accordance with State of ND Highways Standards, FAA 42 Mix.
- C. Aggregate for Wearing Course: In accordance with State of ND Highways Standards, FAA 42 Mix.
- D. Fine Aggregate: In accordance with State of ND Highways Standards, FAA 43 Mix.
- E. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
- F. Tack Coat: In accordance with State of North Dakota Highways standards.
 - 1. Material shall be SS-1h.
- G. Asphalt Cement
 - 1. Asphalt cement shall be Performance Graded Asphalt Cement meeting the requirements of AASHTO MP1, PG 58-28.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.03 SOURCE QUALITY CONTROL

- A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions.
- B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.05 gal/sq yd.
- C. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.03 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place base course to thickness identified in schedule at end of section.
- B. Place wearing course within 24 hours of applying tack coat.
- C. Place wearing course to thickness identified in schedule at end of section.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 014000 for general requirements for quality control.
- B. Take samples and perform tests in accordance with AI MS-2

3.06 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.

3.07 SCHEDULE

- A. Pavement thickness shall match noted parking areas: See plan and detail for sections.

END OF SECTION

SECTION 321313
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks, integral curbs, gutters, and driveways.

1.02 RELATED REQUIREMENTS

- A. Section 312323 - Fill and Backfill: Compacted subbase for paving.
- B. Section 321123 - Aggregate Base Course: ND Class 5 aggregate base course or salvaged base course.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- D. ACI 305R - Hot Weather Concreting; 2010.
- E. ACI 306R - Cold Weather Concreting; 2010.
- F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- H. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- J. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- K. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.
- L. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- M. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- N. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.
- O. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on admixtures and curing compound.
- C. Design Data: Indicate designed concrete strength and typical details.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Forms shall be metal or wood, with sections that interlock and are at least 10 feet in length. The forms shall be of the same thickness as the concrete to be placed against them and shall have a base width of at least 2/3 their height. They shall have at least 3 stake pockets for every 10 feet of length and the bracing and support must be able to withstand the pressure of the concrete and weight and thrust of the machinery operating on the forms. Forms shall be set upon the compacted subgrade at to exact line and grade for a distance of at least 300 feet in advance of the concrete placing operation. Metal forms shall be oiled or coated with soft soap or whitewash before depositing the concrete against them. Forms shall be mortar and dirt free and shall be checked with a 10-foot straightedge and any variation in excess of 1/8 inch shall be corrected.
- B. Approved flexible or curved forms of proper radius shall be used on curves having a radius 150 feet or less. Straight forms longer than 10 feet shall not be used on any curved line unless approved by the Engineer. If the pavement is being placed contiguous to previously finished pavement or curb and gutter, such finished pavement or curb and gutter may be made to serve as a side form if found to be suitable in the opinion of the Engineer.

2.02 AUXILIARY FINISHING EQUIPMENT AND MATERIAL

- A. Straight Edge
 - 1. Two or more ten (10) foot straight edges of an approved type shall be used. Extra blades shall be provided and used when previously used edges become wavy and warped.
- B. Floats
 - 1. Approved long-handled floats, each having a blade at least 3 feet in length and 6 inches in width.
- C. Master Straight-Edge
 - 1. All straight edges shall be tested by the master straightedge before being used and frequently during their use.
- D. Brooms
 - 1. Brooms shall be of an approved push type not less than 18 inches long, from good quality bass or bassine fiber not more than five (5) inches in length. The handle shall be at least one foot longer than one-half the pavement width and shall be readily adjustable.

2.03 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) yield strength; deformed billet steel bars; unfinished.
- B. Fiber reinforcement bars will not be allowed unless approved by the owner.
- C. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi yield strength; deformed billet steel bars; unfinished finish.
- D. Deformed steel bars meeting the Specifications for bar reinforcement shall be used for the tie bars joining slabs together across longitudinal joints or joining slabs to the curb and gutter section.

- E. Bars carried over as excess from previous year's construction shall not be used on any project unless documentation of protection from the sun is given to the Engineer. Bars showing rust through the coating shall be rejected for use on a project. Epoxy coatings shall be 8 to 12 mils in thickness.

2.04 JOINT MATERIALS

A. Expansion Joints

1. If expansion or isolation joints will be required, they shall be as indicated in the diagrams. Expansion/Isolation joint material shall conform to ASTM D-1751. Joint material shall be 1-inch in thickness, 1/2 inch less in height than the pavement depth. It shall extend the full width of the pavement slab and curb, and any concrete at the ends when the forms are removed shall be chipped away. The dowel support shall securely and rigidly hold the dowel bars and premolded filler in correct position during the paving operation. All expansion/Isolation joint faces shall be cleaned by sandblasting and sealed with silicone sealant to produce a slightly concave surface approximately 1/4 inch below the concrete surface.
2. The expansion joint dowel bar assembly shall be of a type as manufactured by Dayton Superior, Wady Industries, Construction Materials, Inc., Laclede Steel Company, the Bethlehem Steel Company, the American Steel and Wire Company, or approved equal. The entire expansion joint assembly shall be of a type approved by the Engineer.

B. Silicone Joint Sealant

1. The sealant shall be a Low Modulus Silicone Sealant meeting the requirements of the NDDOT Specifications, Section 826.02.B.1. Self-leveling silicone sealants will not be allowed.

2.05 CURING COMPOUNDS

- A. Linseed oil based or poly-alpha-methylstyrene liquid curing compound, white pigmented conforming to the requirements of AASHTO M 148 Type 2, Class B.

2.06 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Cement: ASTM C 150 Normal - Type I or II Portland type, grey color.
- C. Fine, Angular and Coarse Mix Aggregates: ASTM C 33.
- D. Fly Ash: ASTM C618, Class C.
- E. Water: Clean, and not detrimental to concrete.
- F. Air-Entraining Admixtures: ASTM C260/C260M.
- G. Chemical Admixtures: ASTM C 494/C 494M.
 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.07 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 1. For trial mixtures method, employ independent testing agency acceptable to Owner's Representative for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- D. Concrete Properties:
 1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4500 psi.

2. Fly Ash Content: Maximum 20 percent of cementitious materials by weight.
 - a. Fly ash content of mixes (cold weather) will be reduced to zero when placed after October 20th and before April 1st without an adequate cold weather management plan.
 3. Cement Content: Minimum 564 lb per cubic yard.
 4. Water-Cement Ratio: Maximum 40 percent by weight.
 5. Total Air Content (exposed slabs only): 6% shall be targeted, (5-7 percent range), determined in accordance with ASTM C173/C173M.
 6. Maximum Slump: 4 inches.
- E. Aggregate:
1. For all paving applications, mixes shall generally be provided with gradations considered well-graded by specification as determined by the most current NDDOT specification for Well-Graded Aggregates for concrete. Optimization techniques will be used to prepare the final gradations for workability and coarseness factor considerations. Fine and coarse aggregates for all other mixes shall conform to the requirements of ASTM C33 for Concrete Aggregates and meet the following requirements.
 - a. Fine Aggregates
 - 1) 3/8 Inch sieve: 100 percent passing.
 - 2) No. 4 sieve: 95 to 100 percent passing.
 - 3) No. 16 sieve: 45 to 80 percent passing.
 - 4) No. 50 sieve: 10 to 30 percent passing.
 - 5) No. 100 sieve: 0 to 10 percent passing.
 - 6) No. 200 sieve: 0 to 3 percent passing.
 - 7) The maximum limits of deleterious material shall not exceed the limits stated in ASTM C33-93. Shale content shall be less than 0.5%.
 - b. Coarse Aggregates
 - 1) 1-1/2 Inch sieve: 100 percent passing.
 - 2) 1 Inch sieve: 95 to 100 percent passing.
 - 3) 1/2 Inch sieve: 25 to 65 percent passing.
 - 4) 3/8 Inch sieve: 15 to 55 percent passing.
 - 5) No. 4 sieve: 0 to 10 percent passing.
 - 6) No. 8 sieve: 5 percent passing.
 - 7) The maximum limits of deleterious material shall not exceed the limits stated in ASTM C33-93, Class 4S; the total of all deleterious substances, excluding No. 200 material, shall not exceed 2.3% by weight. Shale content shall be less than 0.5%. The aggregate shall show a loss of not more than 35% when tested in accordance with ASTM C131. Crushed hydraulic cement concrete will not be allowed.

2.08 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. See Section 321123 for construction of base course for work of this Section.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Notify Owner's Representative minimum 24 hours prior to commencement of concreting operations.

3.04 REINFORCEMENT

- A. Place reinforcement as indicated on plans.

3.05 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.06 PLACING CONCRETE

- A. All concrete shall be placed with formwork unless placed by a curb machine or mechanical paver. Curb and gutter may be installed integral with the concrete pavement except at curb radii and one full panel height on each side of inlet castings not located in a radius, where it shall be installed separate. After mixing, the concrete shall be handled rapidly and the successive batches deposited in a continuous operation until individual sections are completed. The concrete shall be placed so segregation and unnecessary rehandling is avoided. Immediately prior to placing the concrete, the inside of the forms shall be wetted and the aggregate base moistened with water. The forms shall be filled and concrete brought to the established grade. Trucks hauling concrete shall not back over reinforcing or over previously deposited concrete. Ruts exceeding ½ inch in depth shall be filled with granular material prior to the placing of concrete. Concrete shall not be placed on a frozen subgrade or base.
- B. The mixed concrete shall be deposited on the subgrade to the required depth and for a width not exceeding the direct reach of the mixer boom, in successive batches and in a continuous operation without the use of intermediate forms or bulkheads between joints. If concrete placement is temporarily interrupted, the unfinished face of the concrete shall be covered with wet burlap or plastic sheeting. When placement operations are resumed, the concrete shall be broken down and thoroughly consolidated with the fresh concrete. If the elapsed time between placement loads of concrete exceeds 45 minutes, a transverse construction joint shall be installed. While being placed, the concrete shall be vibrated with spud type vibrators or a vibrating screed so that the formation of voids or honeycomb is prevented. The concrete shall be especially well vibrated against the forms and along fixed structures.

3.07 JOINTS AND SAWING

- A. Joints in concrete pavement shall be of the design specified and shall be constructed at the spacing and locations shown on the plans. Where a specific jointing layout is not provided, jointing shall be per the standard detail in these Specifications. The contractor shall establish the joint locations in the field from the plans or standard details. All joints shall be sawed along a true and straight line established by the Contractor and shall not deviate at any point by more than 1/2 inch from the established line.
- B. Transverse Contraction Joints and Sawing
 - 1. The location of each transverse joint shall be marked in a manner satisfactory to the Engineer, prior to placement of the concrete and, in the case of joints that are

to be sawed, the markings shall be transferred to the fresh concrete as soon as the final finishing operations have been completed. All contraction joints shall be sawed to a sufficient depth to control cracking, but in no case to a depth less than 1/4 of the thickness of the pavement plus 1/4 inch. Transverse joints constructed in the pavement shall be extended through the integral or separate curb. The Contractor shall be responsible for sawing to a depth that will prevent uncontrolled cracking. A sufficient number of saw cuts shall be made as soon as possible to relieve the contraction joint tension in the slab. Remaining saw cuts must be made within 48 hours after pouring.

2. The initial sawing shall be accomplished as soon as the condition of the concrete will permit without raveling and before random cracking occurs. The sequence of initial sawing shall be at the Contractor's option. The sawing shall be immediately delayed if any raveling occurs. Water under nozzle pressure shall be used to remove the sawing residue from each joint and the pavement surface immediately after completing the sawing of that joint. Widening of the joints to full width as per dimensions shown on the jointing/sealing detail shall not be performed until the concrete has cured for at least 24 hours and shall be delayed longer when the sawing causes joint raveling.
 3. The early entry dry saw "Soff-Cut" method of sawing will only be allowed with the Engineer's approval for the initial saw-cutting. **Concrete pavement in which uncontrolled cracks occur shall be removed and replaced at the Contractor's expense. The work shall include the complete removal and replacement of a quantity of pavement, to include dowel bar assemblies when applicable, as is determined necessary for acceptance of the pavement by the Engineer. Any/all damage occurring during the removal and replacement process shall be restored at the Contractor's expense . All removal and replacement work shall be in accordance with the requirements of these Specifications.**
- C. Transverse Expansion Joints
1. Expansion joints shall be spaced as shown on the plans and shall be of the preformed type and shall extend entirely through the depth and width of the pavement and through all integral curbs. No concrete shall be left above the expansion material or across the joint, but shall be cut away after the forms are removed.
 2. Dowel bars shall be installed for load transfer across the joint. They shall be held in place midway across the joint, parallel to both the surface and the centerline of the slab by an approved supporting device. The "free" end of the dowel shall be coated with an approved lubricant and covered with an approved metal or plastic dowel cap or sleeve. The preformed filler material shall be accurately pre-punched to fit snugly around the dowel bars.
 3. The expansion material and dowel assembly shall be accurately and firmly staked to the subgrade. The top edge of the filler shall be set 1/2 inch below the pavement surface. During the placing of the concrete, the top edge of the filler shall be protected by a removable channel cap. After the concrete has been placed and finished, the cap shall be removed and the joint edged to the specified radius. All expansion/Isolation joints shall be cleaned by sandblasting and sealed with silicone sealant to produce a slightly concave surface approximately 1/4 inch below the concrete surface.
 4. Before the pavement is opened to traffic, the joint shall be cleaned so that there is a clear space of the specified width for the full depth and width of the pavement. It shall then be filled with joint filler which when cooled shall become flush with the surface of the pavement. Any sealant material on the surface of the pavement shall be removed at the Contractor's expense.
- D. Transverse Construction Joints

1. Transverse construction joints shall be constructed whenever the placing of the concrete is suspended for more than 45 minutes. When the work is suspended near the proper location for an expansion joint, the expansion joint shall be installed in the manner previously specified, except that the concrete shall only be placed on one side of the header, when work is resumed it shall be placed on the other side.
 2. When work is suspended at other locations, a contraction joint shall be formed by securely staking in place at right angles to the subgrade and centerline of the pavement, a bulkhead of wood or metal cut to the cross-section of the pavement and then depositing concrete against it. Before the work is resumed, the bulkhead shall be removed and concrete placed against the face of the older concrete.
 3. Transverse construction joints shall only be constructed at planned transverse joint locations.
 4. Dowel bars shall be installed for load transfer across the joint. The Dowel bars shall be either installed with the construction joint or later drilled in place. If installed with construction joint they shall be held in place midway across the joint, parallel to both the surface and the centerline of the slab by a dowel splicer basket assembly, self supported dowel sleeve, or other supporting device approved by the Engineer. The dowel bars shall be installed within the tolerances specified above for placing reinforcement. One end of the dowel shall be painted or coated with an approved lubricant.
- E. Longitudinal Joints
1. The longitudinal joint between adjoining, separately constructed pavement shall be as constructed as shown on the plans. Tie bars shall be as shown in the detail and may be bent at right angles against the form of the first lane constructed and straightened into final position before the adjacent concrete is placed. Bars may be placed or inserted through small accurately positioned holes or by other approved methods. Tie bars or tie bar baskets shall be placed so that they are not within 12 inches of the intersection of the longitudinal joint and the transverse joint.
 2. If uncontrolled cracking occurs, the concrete pavement shall be completely removed to the nearest planned longitudinal and transverse joints. The removal and replacement method shall be approved by Engineer and at the Contractor's sole expense.

3.08 PAVEMENT FINISHING

- A. Strike-off and compaction shall be done by both vibrating and screeding processes. Separate power machines may be used for each process or both processes may be combined in the same machine, provided controls exist enabling the operator to apply either operation separately or both combined. When weather conditions cause rapid drying of the pavement surface a fine mist or fog spray applied to the concrete surface shall be permitted only if approved by the Engineer – using any other method to apply water to the concrete surface will not be permitted and will result in nonpayment, replacement, and/or repair of the wetted area as determined by the Engineer.
1. Formwork
 - a. Forms shall be left in place for at least 15 hours after placing the concrete, and the method of removing them shall not damage or mar the concrete.
 2. Straight Edge
 - a. The finished surface of the pavement must conform to the grade, alignment, and contour shown on the plans. Immediately following the floating operation, the Contractor shall test the slab surface for trueness with a 10-foot straightedge. The straightedge shall be placed parallel to the pavement centerline and be passed over the slab to reveal any high areas or depressions. The high areas or depressions shall be cut or filled as necessary with the long handled floats and the area checked again with the

straightedge. Successive advances of the straightedge shall overlap by 1/2 the length of the straightedge. The entire surface shall be checked until all variations in excess of 1/8 inch in 10 feet have been eliminated. Special care shall be taken at all headers to ensure this variation is held to a minimum.

3.09 CURB FINISHING

- A. No grout shall be used to finish the curb. After the concrete is poured into the forms, it shall be puddled and spaded so as to ensure a through, dense mixture, eliminate air pockets, and create uniform and smooth sides.
- B. When weather conditions cause rapid drying of the pavement surface a fine mist or fog spray applied to the concrete surface shall be permitted only if approved by the Engineer – using any other method to apply water to the concrete surface will not be permitted and will result in nonpayment, replacement, and/or repair of the wetted area as determined by the Engineer.
- C. Before the curb concrete has thoroughly set, and while the concrete is still green, the forms shall be removed and the front and top side finished with a float or steel trowel to make a uniform finished surface.
 - 1. Rounding Corners
 - a. Whenever corners are to be rounded, special steel trowels shall be used while the concrete is still workable and the corners constructed to the dimensions herein specified. For combined curb and gutter, the top and side of the curb and gutter may be finished by means of a special shaped trowel or by a curb-andgutter machine which shapes the entire surface in accordance with the specified dimensions. This trowel shall be used immediately upon removing the front form while the concrete is still workable but firm enough to stand up.
 - 2. Smoothness
 - a. The top and face of the curb and also the top of the apron on combined curb and gutter must be finished true to line and grade without any irregularities of surface noticeable to the eye. The gutter shall not hold water to a depth of more than 1/4 inch, nor shall any portion of the surface or face of the curb or gutter section depart from more than 1/4 of an inch from a straight edge ten (10) feet in length, placed on the curb parallel to the center line of the street not shall any part of the exposed surface present a wavy appearance.

3.10 FINAL SURFACE FINISH

- A. The edges of the pavement shall be left smooth and true to line, and finished, at about the time the concrete takes its initial set.
- B. After surface irregularities have been removed and before the concrete attains an initial set, the pavement shall be uniformly textured using a seamless strip of artificial grass, or by brooming.
- C. Artificial grass drags or a broom pulled longitudinally in a line parallel to the slab centerline, shall be the texturing method, and shall be maintained in good repair. The texturing material shall apply a uniform texture with 1/16 to 1/8 inch deep striations. The width of the texturing material shall be in full contact over the full width of the pavement. The texturing material shall be cleaned as often as necessary to remove hardened particles or debris that would otherwise scar the surface.
- D. The texturing material being pulled longitudinally shall be mounted to a self-propelled bridge, operated off of the paving string-line, and shall not deviate at any point by more than 1/2 inch from the established alignment.
- E. With formed paving only, brooms shall be drawn across the surface at right angles to the centerline of the pavement, with the stroke of the broom slightly overlapping

adjacent strokes. The brooming operation shall apply a uniform texture with 1/16 to 1/8 inch deep striations. Brooms shall be washed and dried at frequent intervals during the day. Any long or coarse bristles that may cause surface irregularities shall be trimmed or cut out, and any brooms that have become worn out shall be discarded.

- F. Upon completion of the final finishing the surface texture shall be uniform in appearance and free of surface water, rough or porous spots, irregularities, depressions, and other objectionable features.

3.11 CURING AND PROTECTION

A. Normal Pavement

- 1. As soon as the concrete has been textured, the Contractor shall start curing operations. The finished surface shall be sprayed with an approved curing agent on all exposed faces. Sufficient curing compound shall be applied at a rate of approximately 200 SF/gal to ensure a coating as white as a sheet of paper. In lieu of curing agent, the concrete may be cured by wet burlap or other methods approved by the Engineer. When wet burlap or plastic film is used for curing, the curing period shall be at least 5 days. The concrete surface must not be pitted from or damaged from application of water or incidental rain. The Contractor shall protect all concrete from weather conditions, traffic damage, or any other causes occurring prior to its final acceptance. Any damaged section shall be repaired at the Contractor's expense.

B. Timing of Curing Compound Application

- 1. Curing procedures should be undertaken within ½ hour of completion of finishing operations or before the wet sheen on the surface of the concrete disappears, whichever occurs first. Evaporation retarders shall be used for interim protection whenever hot, windy or dry conditions quantified by evaporation rates exceeding 0.2 pounds per square foot per hour exist, and shall be used in accordance with manufacturer's recommendations. Evaporation retarders shall not be used as a finishing aid.

3.12 JOINT FILLING AND SEALING

- A. The Contractor shall not seal joints until they have been inspected and approved by the Engineer. Failure to comply will result in complete removal of the filler/sealer material to allow inspection by the Engineer, at the Contractor's sole expense.
- B. All vertical joint faces shall be cleaned by sandblasting. Oil, asphalt, curing compound, paint, rust, and other foreign materials shall be completely removed. Just before the joints are sealed, the Contractor shall clean the joints with compressed air at a working pressure of at least 90 psi. The joints shall not be sealed when the air temperature is below 40°F. Backer rod shall be used in all joints to control the depth of the filler/sealer material, achieve the desired shape of the material, and support the material against indentation and sag.
- C. The backer rod shall be compatible with the filler/sealer and not subject to the absorption of water. Any joints filled above the specified level shall be corrected by removing and replacing the filler/sealer at the Contractor's sole expense.
- D. Transverse joints constructed in the pavement shall be widened and sealed through the integral or separate curb.
 - 1. Hot Pour
 - a. The joint filler shall be forced into the joint with a pressure type applicator capable of filling the joint from the bottom up to a height approximately ¼ inch below the pavement surface, without any overflow or spillage onto the pavement surface. Any excess filler spilled on the pavement surfaces shall be removed at the Contractor's sole expense.

3.13 PROTECTION OF PAVEMENT

- A. The newly-placed concrete shall be protected from traffic by employing watch persons, if necessary, and by the erection and maintenance of barricades, fences, warning signs and lights, pavement bridges, and cross-overs.
- B. When the temperature is expected to fall below 35°F, suitable measures shall be taken to maintain the concrete surface temperature above 40°F for 5 days or until the concrete attains a compressive strength of 3,000 psi. Admixtures for curing or temperature control shall be used only as permitted or directed. The admixtures shall not be considered as a substitute for any specified curing requirement.
- C. Any concrete pavement damaged before final acceptance, including damage by frost action, shall be repaired to the satisfaction of the Engineer or removed and replaced at the Contractor's sole expense.

3.14 OPENING TO TRAFFIC

- A. Newly constructed pavement shall not be opened to Contractor or public traffic until the concrete has attained a compressive strength of 3,000 psi, as determined by breaking test cylinders cured in the field in a manner that replicates as closely as possible the curing conditions of the pavement. In addition to the strength requirements, the newly constructed concrete pavement shall not be opened to any traffic until all joints have been sealed unless permission is granted by the Engineer. The Contractor shall erect and maintain suitable barricades and lights to protect the pavement from traffic. Any part of the pavement damaged from traffic or other causes occurring prior to the acceptance of the pavement shall be repaired to the satisfaction of the Engineer at the Contractor's sole expense.

3.15 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 014000.
- B. An independent testing agency will perform field quality control tests.
 - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - 3. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- C. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 75 cu yd or less of each class of concrete placed.
 - 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- D. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- E. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

3.16 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

SECTION 323110

SIGNING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Signs.
- B. Posts.
- C. Hardware.

1.02 RELATED REQUIREMENTS

- A. All site signage will meet the current edition of the Manual of Uniform Traffic Control Devices, published by the FHWA.
- B. All sign faces shall be according to detail drawings and the alphabets shown in the MUTCD, Standard Highway signs, and Standard Alphabets, published by FHWA.
- C. Section 013000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- D. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Record actual locations of site signage installed.

1.04 QUALITY ASSURANCE

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

1.05 WARRANTY

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

PART 2 PRODUCTS

2.01 MATERIALS

- A. Flat Sheet Aluminum:
 - 1. ASTM B 209 Alloy 6061 T6 or 5052-H38 with mill finish.
 - a. Thickness
 - 1) equal to or less than 24" width: 80 guage.
 - 2) greater than 24" width: 100 gauge.
 - 3) 30" Stop Signs: 80 Gauge.
 - 2. Mounting Holes: 3/8" diameter to fit 3/8" bolt.
- B. Hardware, Fittings and Posts:
 - 1. All Steel bolts, nuts, U-bolts, lock washers and washers shall be galvanizes tell meeting ASTM A153.
 - a. Bolts: 3/8" diameter steel panel bolts, machine bolts, etc., shall meet SAE J429 Grade 5 or ASTM A449.
 - b. Nuts: Steel hex nuts shall meet SAE J995 Grade 5 or ASTM A563.
 - c. Washers: Steel flat washers shall be fabricated of steel meeting ASTM F844.
 - 2. Posts:
 - a. Telespar 12 gauge brand.
 - b. Vertical Clearance (ground to bottom of sign)
 - 1) Single Sign: 7 feet
 - 2) Double Sign: 6 feet
 - c. Anchor Posts:

- 1) Length: 4 feet.
3. Post Sleeves:
 - a. 18" Omni-Directional Sleeve or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Each sign shall be located according to the plans or adjusted with the Engineer's approval. Installed signs will be inspected at night for maximum effect. If any sign is ineffective at night, the sign shall be replaced at the Contractor's expense.
- B. All sign fabrication, packaging, labeling, handling, and shipping shall follow the latest version of the NDDOT Standard Specifications for Road and Bridge Construction.
- C. Anchors and Anchor Sleeves for telescoping perforated tube supports shall be driven. The perforated tube anchor and sleeve shall be driven to a height of 5-6 inches above the ground. Anchors and sleeves shall be installed per the detail.

END OF SECTION

SECTION 323113
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Posts, rails, and frames.
- B. Wire fabric.
- C. Concrete post footings
- D. Manual gates with related hardware.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 321313 - Concrete Paving.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. 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; 2014.
- F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- G. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2011.
- H. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric; 2011.
- I. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework; 2014.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Fence framework, fabric, and related accessories to be complete system as specified herein.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Allied Tube and Conduit Corporation.
- B. Anchor Fence, Inc.

- C. Cyclone Fence / United States Steel Corporation.
- D. Approved equal.

2.02 MATERIALS

- A. Posts, Rails, and Frames: ASTM F1043 WT-40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 50 ksi.
- B. Wire Fabric: ASTM A392 zinc coated steel chain link fabric.
- C. Concrete: ASTM C94/C94M, ready-mixed; Normal portland cement, 3,000 psi strength at 28 days, 3 inch slump; 1-1/2 inch nominal sized coarse aggregate.

2.03 COMPONENTS

- A. Line Posts:
 - 1. Type I or Type II round.
 - 2. Fabric height 6' and under, line post outside diameter equals 2".
- B. Corner and Terminal Posts:
 - 1. Type I or Type II round.
 - 2. Fabric height 6' and under, corner or terminal post outside diameter equals 3".
- C. Gate Posts:
 - 1. Type I or Type II round.
 - 2. Single gate width up to 6', gate post outside diameter equals 3".
- D. Top and Brace Rail:
 - 1. Type I or Type II round.
 - 2. 1-5/8" outside diameter.
- E. Gate Frame:
 - 1. Type I or Type II round.
 - 2. 1-5/8" outside diameter.
 - 3. Welded joints.
- F. Fabric: 2 inch diamond mesh interwoven wire, 9 gage, 0.1144 inch thick, top selvage twisted tight, bottom selvage knuckle end closed.
- G. Tension Wire: 7 gage thick steel, single strand.

2.04 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- C. Privacy Slats: Vinyl strips, sized to fit fabric weave.
 - 1. Color to be selected by owner from manufacturers standard color palatte.

2.05 FINISHES

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot.
- B. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.
- C. Accessories: Same finish as fabric.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567 and plan details.
- B. Place fabric on outside of posts and rails.
- C. Set terminal posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.

- D. Line posts shall be driven and set plumb: 6 feet, see plan detail.
- E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567, see plan detail.
- F. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
- G. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
- H. Do not stretch fabric until concrete foundation has cured 28 days.
- I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
- J. Position bottom of fabric 2 inches above finished grade.
- K. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
- L. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- M. Install bottom tension wire stretched taut between terminal posts.
- N. Do not attach the hinged side of gate to building wall; provide gate posts.

3.02 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Position: 1 inch.
- C. Components shall not infringe adjacent property lines.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.

3.04 CLEANING

- A. Leave immediate work area neat at end of each work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean fence with mild household detergent and clean water rinse well.

END OF SECTION

SECTION 329219

SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Seeding, mulching and fertilizer.

1.02 RELATED REQUIREMENTS

- A. Section 015713 - Erosion Control.
- B. Section 312200 - Site Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

1.03 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 PRODUCTS

2.01 NON-IRRIGATED SEED MIXTURE

- A. Seed: Shall be labeled in accordance with USDA Rules and Regulations under The Federal Seed Act. Wet, moldy, or otherwise damaged seed will not be accepted. Weed seed not to exceed 0.5% of total mixture. Mixture requirements as follows:
- B. Non-Irrigated Seed Mixture: Fescue Mix
 - 1. Chewing Fescue:
 - a. 29.7% by Weight.
 - 2. Creeping Red Fescue:
 - a. 29.1% by Weight.
 - 3. Hard Fescue:
 - a. 19.8% by Weight.
 - 4. Sheep Fescue:
 - a. 19.6% by Weight.
 - 5. Crop Seed:
 - a. 0.12% by Weight.
 - 6. Inert:
 - a. 1.57% by Weight.
 - 7. Weed:
 - a. 0.11% by Weight.
- C. Rate of Seeding = 260 pounds per Acre.

2.02 SOIL MATERIALS

- A. Topsoil: Excavated from site and free of weeds.

2.03 ACCESSORIES

- A. Mulching Material: Wood cellulose fiber, chip form, free of growth or germination inhibiting ingredients.
- B. Fertilizer: recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, to the following proportions:
 - 1. Nitrogen: 5 percent.
 - 2. Phosphoric Acid: 10 percent.
 - 3. Soluble Potash: 5 percent.
- C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is free of stones, sticks, roots, and other debris. Any debris shall be disposed of by the Contractor at no additional cost to the Owner.

3.02 PREPARATION

- A. Prepare subgrade in accordance with Section 312200.
- B. Place topsoil in accordance with Section 312200.

3.03 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 SEEDING

- A. Seeding: Soil shall be moist when seeding. Seed shall be mechanically sown with a drill or Brillion type seeder. Seed may be broadcast sown in small areas and covered 1/2 inch by a harrow or approved device. Apply seed uniformly at the specified rate for the mix.
- B. Apply seed evenly in two intersecting directions. Rake in lightly.
- C. Do not seed areas in excess of that which can be mulched on same day.
- D. Do not sow immediately following rain, when ground is too dry, on standing water, on frozen ground, or when wind exceeds 15 mph.
- E. Roll seeded area with roller not exceeding 112 lbs.
- F. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
- G. Apply water with a fine spray immediately after each area has been mulched. Saturate top 4 inches of soil.
- H. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.05 HYDRO MULCHING

- A. Apply mulch slurry at a rate of 45 lbs per 1000 sq ft evenly in two intersecting directions. The mulch shall have a tacking and bonding agent to ensure lasting

stabilization and reduce erosion potential. The tackifier shall be installed per manufacturer's recommendations.

3.06 PROTECTION

- A. Damaged or dead seeded areas shall be replaced at no expense to the Owner for a period of 1 year after final acceptance has been made.
- B. Cover seeded slopes where grade is 4 inches per foot or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- C. Water to prevent grass and soil from drying out.
- D. Maintain seeded areas after placement until grass is well established and exhibits a vigorous growing condition.
- E. Immediately reseed areas that show bare spots.

3.07 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings that fail in materials, workmanship, or growth within specified warranty period.
- B. Failures include, but are not limited to, the following:
 - 1. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents beyond Contractor's control.
- C. Warranty Periods from Date of Substantial Completion:
 - 1. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - 2. Ground Covers, Perennials, and Other Plants: 12 months.
- D. Include the following remedial actions as a minimum:
 - 1. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
 - 2. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
 - 3. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
- E. Provide extended warranty for period equal to original warranty period, for replaced plant material.

END OF SECTION

SECTION 330110.58
DISINFECTION OF WATER SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of site domestic water lines and site fire water lines specified in Section 331416.
- B. Testing and reporting results.

1.02 RELATED REQUIREMENTS

- A. Section 331416 - Site Water Utility Distribution Piping.

1.03 REFERENCE STANDARDS

- A. AWWA B300 - Hypochlorites; 2011.
- B. AWWA C651 - Disinfecting Water Mains; 2005.

1.04 SUBMITTALS

- A. Test Reports: Indicate results comparative to specified requirements.
- B. Disinfection report:
 - 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:
 - 1. Date issued, project name, and testing laboratory 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 of the North Dakota Department of Health.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code or regulation for performing the work of this Section.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate, and AWWA B303 Sodium Chlorite.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested.

- B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 DISINFECTION

- A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.
- B. Provide and attach equipment required to perform the work.
- C. All water mains shall be chlorinated as set forth by the latest revision of AWWA C601. Sufficient chlorine tablets or powder shall be placed in each pipe to furnish a resultant solution of 50 to 100 parts per million of available chlorine. Generally required dosage to meet this standard is as follows:

WATERMAIN SIZE	REQUIRED DOSAGE
>2"	1 LB PER 10,000 FEET
4"	1 LB PER 2,500 FEET
6"	1 LB PER 1,100 FEET
8"	1 LB PER 700 FEET
10"	1 LB PER 350 FEET
12"	1 LB PER 280 FEET
16"	1 LB PER 160 FEET

- D. Introduce treatment into piping system.
- E. The chlorinated water shall remain in the pipeline for at least 24 hours and shall have a residual chlorine content of at least 5 parts per million at that time.
- F. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- G. Replace permanent system devices removed for disinfection.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 014000.
- B. If tests indicate that work does not meet specified requirements, remove work, replace and retest at no cost to the Owner.
- C. Test samples in accordance with AWWA C651.

END OF SECTION

SECTION 330561
CONCRETE MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Monolithic precast concrete manholes with transition to lid frame, covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 31 2316.13 - Trenching.
- B. Section 31 2323 - Fill and Backfill.
- C. Section 33 3111 - Site Sanitary Sewerage Gravity Piping.

1.03 REFERENCE STANDARDS

- A. ASTM C478/C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2020.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate manhole locations, elevations, piping sizes, elevations of penetrations, and resilient rubber connectors.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 SANITARY SEWER MANHOLES

- A. Casting: Neenah R-1955-1 floating casting, or approved equal, with a self-sealing lid, concealed pick bar, and the word "SANITARY" cast into the center of the lid in letters 2 inches high.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 MANHOLES

- A. Place concrete base pad, trowel top surface level.
- B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
- C. Cut and fit for pipe.

- D. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- E. Set cover frames and covers level without tipping, to correct elevations.
- F. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION

SECTION 331416
SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water pipe for site conveyance lines.
- B. Pipe valves.

1.02 RELATED REQUIREMENTS

- A. Section 330110.58 - Disinfection of Water System: Disinfection of site service utility water piping.
- B. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 332000 - Utility Identification Tracer Wires.

1.03 REFERENCE STANDARDS

- A. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.
- B. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2009.
- C. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2007.
- D. AWWA C904 - Cross-Linked Polyethylene (PEX) Pressure Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service; 2016.

1.04 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Polyvinyl Chloride (PVC) Pipe
 - 1. Manufacture: shall be marked to indicate compliance with NSF 61, Factory Mutual (FM) and either be marked or tagged with Underwriter Laboratory (UL) approval. 12" and smaller PVC pressure pipe shall be manufactured in accordance with the latest revision of AWWA Standard C900. The pipe shall be Class 150, DR 18.
 - 2. Joints: shall be rubber gasketed conforming to the requirements of ASTM D-3139-98 or the latest revision.
 - 3. Fittings: Shall conform to the requirements of AWWA C-907 and carry a working pressure of 150 psi. The PVC fittings shall be of the slip joint type.
- B. Crosslinked Polyethylene Tubing: AWWA C904.
 - 1. Fittings: AWWA C800, insert-stiffener type.
 - 2. Joints: Cold expansion fittings with PEX reinforcing rings, complying with ASTM F1960
- C. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

2.02 VALVES

- A. Gate Valves 3 Inches and Over:

1. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends, control rod, post indicator, valve key, and extension box.
- B. Ball Valves Up To 2 Inches:
 1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.
 2. Approved ball valve manufacturers:
 - a. Mueller Oriseal.
 - b. Ford.
 - c. McDonald.
 - d. Or approved equal.

2.03 VALVE BOXES

- A. General:
 1. Valve boxes will be required on all valves. All valve boxes shall be of cast or ductile iron in accordance with ASTM A 48 30B material specification with a minimum tensile strength of 30,000 psi, have screw type adjustment, be of the three-piece type, 5 1/2" shaft, size G, and be furnished with cast iron bases and covers. The valve box shall include necessary extensions. Covers shall be cast with "WATER" on them and be American made. Boxes shall be either American made or heavy-duty foreign made boxes that meet or exceed the weight of the American-made box. Acceptable boxes are the Tyler and Star heavy-duty series boxes. The valve box shall be wrapped with polyethylene plastic film.
- B. Valve Box Adaptors
 1. Rubber valve box adaptors shall be installed for all valve boxes on all gate valves and butterfly valves. The adaptor shall be the Valve Box Adaptor II as manufactured by Adaptor, Inc. or as approved by the Engineer.

2.04 CORPORATION STOP

- A. Corporation stops shall be:
 1. Mueller H-15000.
 2. Ford F-600.
 3. McDonald 1701.
 4. Or approved equal

2.05 HYDRANTS

- A. Hydrants: AWWA C502, UL 246, dry barrel type.
 1. Main valve opening: 5" minimum.
 2. Hydrant barrel: 7 3/8" minimum inside diameter.
 3. Type of shut-off: Compression.
 4. Inlet connection: 6" size - bell or mechanical joint type.
 5. Nozzles: (2) 2 1/2" hose nozzles; (1) 4 1/2" pumper nozzle.
 6. Nozzle threads: National Standard threads.
 7. Bury depth: 8'-6".
 8. Operating & cap nuts: Standard (NST).
 9. Direction to open: to the left (counter-clockwise).
 10. Paint: Standard Red above ground line.
 11. Bolts: All bolts below ground shall be stainless steel.
 12. Acceptable manufacturers are Waterous WB67-250 Pacer.
- B. Finish: Primer and two coats of enamel in color required by utility company.

2.06 SERVICE CONNECTIONS

- A. All service connections to PVC pipe shall be stainless steel, double bolt (minimum) service saddles.

- B. Service saddles shall have stainless steel washers between the nut and the plastic washer to equalize tightening stress.
- C. Rubber tapered gaskets shall be required to resist circumferential and longitudinal forces along with O-ring or flat gaskets for hydraulic seal.
- D. Saddle bolts shall be tightened to the manufacturers recommended tightness and verified with a torque wrench.
- E. Bolt tightness shall be rechecked with a torque wrench after the pipe tap is complete.
- F. All services shall be pressure tested with the main.
- G. Approved saddle types:
 - 1. Romac style 304.
 - 2. Ford style FS 303.
 - 3. Powerseal 3412AS.
 - 4. Cascade CSC-1 and CSC-2.
 - 5. Or approved equal.

2.07 COUPLINGS

- A. All pipe couplings up to and including 12" in diameter shall be epoxy coated ductile iron meeting or exceeding the requirements of ASTM A 536, grade 65-45-12. Couplings shall meet the requirements of AWWA C219. The coupling shall carry a minimum working pressure of 150 psi, have end rings that are segmented and joined with a pinless hinge, gaskets formed from virgin Nitrile Butadiene Rubber (NBR) compounded for water and sewer service in accordance with ASTM D2000, and 304 stainless steel armor. Fasteners shall be 304 stainless steel.

2.08 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 312316.13.
- B. Cover: As specified in Section 312316.13.

2.09 ACCESSORIES

- A. Concrete for Thrust Restraints.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. See the sections on excavation and fill for additional requirements.
- B. See Section 312316.13 for additional requirements.
- C. Hand trim excavation for accurate placement of pipe to elevations indicated.
- D. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil as indicated in drawings.

3.04 INSTALLATION - PIPE

- A. Maintain 10' separation of water main from sewer piping.

- B. Group piping with other site piping work whenever practical.
- C. Establish elevations of buried piping to ensure not less than 8.0 feet of cover.
- D. Install pipe to indicated elevation to within tolerance of 5/8 inches.
- E. Install ductile iron piping and fittings to AWWA C600.
- F. Install crosslinked polyethylene tubing and fittings to AWWA C904.
- G. Route pipe in straight line.
- H. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- I. Slope water pipe and position drains at low points.

3.05 INSTALLATION - VALVES

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.
- C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway in ac
- D. Set hydrants to grade, with nozzles at least 20 inches above ground
- E. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inches washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

3.06 THRUST BLOCKING

- A. All fittings shall be braced by means of poured concrete or concrete thrust blocks. No wood thrust blocks will be allowed. Poured concrete shall be 3000 psi concrete poured against undisturbed earth. Care shall be taken not to cover up joints, bolts, flanges, and the fittings with concrete.
- B. Thrust restraint at the joints may be used in lieu of concrete thrust blocking with the permission of the Engineer. Restraint devices for PVC pipe shall meet or exceed the requirements of ASTM F 1674-96 or the latest revision, Standard Test Method for Joint Restraint Products for Use with PVC Pipe.

3.07 TEMPORARY WATER SERVICES

- A. If the water to a property is to be out for more than 12 hours, the Contractor will be responsible for providing a temporary water service to the affected water users. The method of providing the temporary water service shall be an option of the Contractor subject to the approval of the Engineer.
- B. All temporary water mains and services shall be disinfected in accordance with Disinfection of Water Utility Distribution. One water sample at the end of a service connection will be taken after the temporary water line is flushed. The sample shall show the absence of bacteria before connections are allowed.

3.08 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Perform field inspection and testing in accordance with Section 014000.
- C. Hydrostatic Testing will be provided by the Contractor and paid by the Owner.
- D. NSF Declaration: All products (treatment chemicals and materials) that may come into contact with water intended for use in a public water system shall meet American National Standards Institute (ANSI) /National Sanitation Foundation (NSF) International Standards 60 & 61, as appropriate. A product will be considered as meeting these standards if so certified by NSF, the Underwriters Laboratories, or other organizations accredited by ANSI to test and certify such products.
- E. Hydrostatic Test:

1. Watermain shall be subjected to a hydrostatic test of 125 psi for a period of one hour and shall be held within 2 psi of the test pressure for the entire duration.
- F. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

END OF SECTION

SECTION 332000
UTILITY IDENTIFICATION TRACER WIRES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Utility Identification Tracer Wires for Site Water Utility Distribution Piping.

1.02 RELATED REQUIREMENTS

- A. Section 331116 - Site Water Utility Distribution Piping.
- B. Section 331300 - Disinfection of Water System.

1.03 REFERENCE STANDARDS

- A. ASTM B910/B910M: Standard Specifications for Annealed Copper-Clad Steel Wire.

1.04 SUBMITTALS

- A. Product Data: Submit product manufacturer literature, color choices, options, installation instructions, and included parts.

1.05 QUALITY ASSURANCE

- A. Trace Wire:
 - 1. All installed trace wire shall be verified as operational using Contractor's locating equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in undamaged, unopened container, bearing manufacturer's original labels. Inspect for damage.
- C. Protect materials from damage by storage in secure location.

1.07 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for Coordination.

PART 2 PRODUCTS

2.01 UTILITY IDENTIFICATION TRACER WIRE

- A. Manufacturers
 - 1. Copperhead Industries, LLC; Monticello, MN
 - 2. Approved Equal
- B. Insulation color coded to marked utility according to the American Public Works Association (APWA) uniform color standards.

2.02 SPLICE CONNECTORS

- A. Manufacturers
 - 1. Copperhead Industries, LLC; Monticello, MN
 - 2. Approved Equal

2.03 TERMINAL BOXES

- A. Manufacturers
 - 1. Copperhead Industries, LLC; Monticello, MN
 - 2. Bingham & Taylor (P202CGN); Culpeper, VA
 - 3. Approved Equal
- B. Flush Mount Terminal Boxes
 - 1. Minimum 36" long, 2-1/2" diameter ABS shaft.

2. Flared shaft bottom.
 3. Permanently magnetic cast or ductile iron cover frame and lid.
 4. Variable size wire terminal blocks beneath lid.
 5. Integral direct connection terminal to allow connection of locator without removing the lid.
 6. Locking cover with pentagon nut.
 7. Lid stamped with utility type and color coded to marked utility according to the American Public Works Association (APWA) uniform color standards.
- C. Above grade terminal boxes:
1. PVC terminal box with 1" diameter conduit connection.
 2. Minimum 2 terminals with jumper.
 3. Color coded to marked utility according to the American Public Works Association (APWA) uniform color standards.

2.04 GROUNDING ANODE

- A. Manufacturers:
1. Copperhead Industries, LLC; Monticello, MN
 2. Approved Equal

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify tracer wire installation locations, termination points, and connection points to existing tracer wire systems.

3.02 PREPARATION

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Remove insulation from splices and terminations as necessary according to manufacturer's instructions.

3.03 INSTALLATION

- A. Tracer wire:
1. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
 2. Tracer wire system must be installed as a continuous single wire. No looping or coiling of wire is allowed.
 3. Attach tracer wire to utility pipes and services at 8' to 12' intervals using tape or plastic zip ties installed all the way around the utility pipe. Allow for 1 to 3 inches of slack between the pipe and the tracer wire between attachment points.
 4. Install mainline pipe tracer wire continuously on the top center of utility pipes, running around or through valves, manholes, or other structures.
 5. All connections between individual tracer wires will be made with approved splice connectors only.
 6. Any damage occurring during installation of the trace wire must be immediately repaired in an approved waterproof method. Taping and/or spray coating shall not be allowed.
 7. Where existing trace wire is encountered on an existing utility that is being extended or tied into, the new and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location

- as specified.
8. Where tracer wire is terminated at a mainline dead end/stub, connect a grounding anode at the end of the pipe and leave a 3' pigtail of tracer wire laid horizontally beyond the pipe.
 9. Install branching mainline, service pipe, or hydrant lead tracer wire as a single continuous wire between the mainline wire and either a terminal box or a ground anode. Connect to the mainline wire with approved connector without cutting/splicing the mainline tracer wire. No looping or coiling of wire is allowed.
 10. Water main and water services will require tracer wire. All tracer wire installed on services shall terminate at the gate valve with a 1/2" - 1" bronze ground clamp. The ground clamp shall be completely wrapped in a flexible protective seal. The seal shall be a 4"x4" Air-Seal as manufactured by Cooper Power Systems or approved equal.
- B. Flush mount terminal boxes:
1. Install flush mount terminal boxes at finished ground elevations as shown in the drawings and details, or as directed by the Engineer.
 2. Provide 3 feet of extra tracer wire and grounding anode leader wire in the flush mount terminal box.
 3. Connect tracer wire and grounding anode leader wire to flush mount terminal box cap according to manufacturer's instructions.
- C. Above grade terminal boxes:
1. Install above grade terminal boxes as shown in the drawings and details, or as directed by the Engineer.
 2. Provide 4 inches of extra tracer wire and grounding anode leader wire in the terminal box. Connect tracer wire.
 3. Connect tracer wire and grounding anode leader wire to different terminal posts with a manually removable jumper between them according to manufacturer's recommendations.
- D. Grounding anode:
1. Install grounding anodes at all dead ends/stubs, at all terminal boxes, and at all branches in the mainline tracer wire.
 2. Install grounding anodes vertically beneath the pipe and connect to the tracer wire system as specified.
 3. At dead end/stub locations, connect the grounding anode leader wire to the tracer wire and trim the anode leader wire to length. No looping or coiling of excess anode leader wire is allowed.
 4. At terminal boxes, connect the grounding anode leader wire to the terminal box cover or connecting stud. Do not connect the grounding anode leader directly to the tracer wire.

3.04 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Prohibited products and methods:
1. Uninsulated tracer wire or insulated tracer wire using any insulation other than HDPE.
 2. Twist-on wire nuts or connectors.
 3. Tape or spray-on waterproofing.
 4. Any installation with multiple wires laid side-by-side or twisted together.
 5. Connecting the tracer wire to any conductive utilities.
- C. Post-installation Test:
1. All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the Contractor, Engineer, and Owner as applicable, prior to acceptance of ownership.

2. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.
3. Continuity testing in lieu of actual line tracing shall not be accepted.

END OF SECTION

SECTION 333113
SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage drainage piping, fittings, and accessories.
- B. Connection of building sanitary drainage system to municipal sewers.

1.02 RELATED REQUIREMENTS

- A. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

- A. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2014.
- B. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, and pipe accessories.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Plastic Pipe: ASTM D3034, Type PSM, Schedule 26 Poly(Vinyl Chloride) (PVC) material; inside nominal diameter as indicated in plans, bell and spigot style solvent sealed joint end.
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 BEDDING AND COVER MATERIALS

- A. Pipe Bedding Material: As specified in Section 312316.13.
- B. Pipe Cover Material: As specified in Section 312316.13.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 312316.13 for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

- B. Connect to building sanitary sewer outlet and municipal sewer system , through installed sleeves.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 014000.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.04 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 334213
STORMWATER CULVERTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe culvert, joints and accessories for temporary drainage.

1.02 RELATED REQUIREMENTS

- A. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

- A. ASTM A929/A929M - Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe; 2001 (Reapproved 2013).

1.04 SUBMITTALS

- A. Product Data: Provide data on pipe, fittings and accessories.
- B. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 STEEL CULVERT PIPE

- A. Corrugated Steel Pipe: Fabricated of ASTM A929/A929M galvanized steel sheet:
 - 1. Helical lock seam.
 - 2. Shape: Circular, with nominal diameter of 12 inches.
- B. Tapered Ends: Same material as pipe, machine cut, for joining to pipe end.
- C. Coupling Bands: Galvanized steel, 0.052 inches thick x 10 inches wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

2.02 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 312316.13.
- B. Cover: As specified in Section 312316.13.

PART 3 EXECUTION

3.01 EXCAVATING

- A. Excavate culvert trench to 12 inches below pipe invert. Hand trim excavation for accurate placement of pipe to elevations indicated.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe and accessories in accordance with manufacturer's instructions.
- C. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.
- D. Shore pipe to required position; retain in place until after compaction of adjacent fills. Ensure pipe remains in correct position and to required slope.

3.03 TOLERANCES

- A. Lay pipe to alignment and slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- B. Maximum Variation From Intended Elevation of Culvert Invert: 1/2 inch.
- C. Maximum Offset of Pipe From True Alignment: 1 inch.

D. Maximum Variation in Profile of Structure From Intended Position: 1 percent.

3.04 PROTECTION

A. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION